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Construction Methods and Equipment

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July 1937

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CLAMSHELL BUCKET discharges rock for sea wall at Golden Gate Exposition Island being formed by dredging in San Francisco Bay.

Preview of the Steel You Buy from Inland

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CURRENT JOBS

. . . . and Who's Doing Them

Construction Methods and Equipment

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JULY, 1937

Buildings

Public — Low bidders on mass housing projects of the Housing Division, PWA, were the following: Parkside housing project, Detroit, Mich., **John Griffith & Sons Co.**, Chicago, $3,443,000; Brewster housing project, Detroit, Mich., **M. L. Bein**, $2,971,000; Baker Homes, Lackawanna, N. Y., **Fleischer Engineering & Construction Co.**, Buffalo, N. Y., $1,353,000; Laurel Homes, Cincinnati, Ohio, **David Gordon**, of Dayton, Ohio, $584,800; housing project Schenectady, N. Y., **A. E. Stephens Co.**, Springfield, Mass., $893,620; Summerfield housing project, Minneapolis, Minn., **Walter Butler & Co.**, Minneapolis, $2,225,000.

At Boston, Mass., a $3,687,000 Suffolk County court house contract went to **George A. Fuller Co.**, of Boston. The successful bidder for a court house in Jamaica, N. Y., was **Wilaka Construction Co.**, of Brooklyn, N. Y., with a tender of $3,678,744. Vocational high school contract in Brooklyn, N. Y., amounting to $1,077,700 was awarded to **Walter Kidde Constructors**, of New York City. For a National Guard armory in St. Louis, Mo., **H. G. Deal & Co.**, bid $723,-117. **H. J. Spieker Co.**, of Toledo, Ohio, is building a school house for $1,021,028. In Baton Rouge, La., three new college dormitories, costing $613,113 are under construction by **Caldwell Bros. & Hart**, of New Orleans. Low bidder for Veterans hospital buildings at White River Junction, Vt., was the **Virginia Engineering Co.**, of Newport, Va., with a price of $509,000.

Commercial — For building 1,000 residences at New Rochelle, N. Y., a $15,000,000 project, the successful bidder was **Summers Engineers & Constructors, Inc.**, of New York City. A $12,000,000 housing project, involving 900 residences, is being started in Jamaica, N. Y., by **United Associates Homes**, of Jamaica, N. Y. A cancer hospital contract in New York City, was awarded to **Marc Eidlitz & Son**, of New York City, for $2,800,000. Contractor for $2,000,000 aquarium at Summer Haven, Fla., is **Hasbrouck Co.**, of New York City. **McCloskey & Co.**, of Philadelphia, are starting work on a $1,000,000 store building for Lit Bros., in Upper Darby, Pa. In Rochester, N. Y., Housing Products, Inc., of Rochester, is building 104 residences to cost $1,000,000. **Turner Construction Co.**, of New York City, has received a $700,000 contract for a New York apartment building. For a store in Fort Worth, Tex., **T. S. Byrne**, of Fort Worth, bid $500,000.

Industrial — Carnegie-Illinois Steel Co., has undertaken, at Clairton, Pa., a $20,000,000 strip mill for which the contract for excavating, grading and sewers went to **A. Guthrie & Co.**, of St. Paul, Minn. Successful bidder on a $5,000,000 Chevrolet factory building in Tonawanda, N. Y., was **Bryant & Detwiler**, of Detroit, Mich. On a $2,800,000 power plant project in West Pittsburgh, Pa., for the Pennsylvania Power Co., contract for stack was awarded to **Rust Engineering Co.**, of Pittsburgh. Habirshaw Cable & Wire Co. has selected the **Austin Co.**, of Cleveland, to build at Yonkers, N. Y., a $1,000,000 plant addition. At Bridgeport, Conn., **Stone & Webster Engineering Co.**, of New York, has sublet an $805,000 rolling mill contract to **Hewlett Construction Co.**, of Bridgeport.

Waterworks

For completion of Bills Brook dam at Hartford, Conn., **B. Perini & Sons, Inc.**, of Framingham, Mass., submitted low bid of $1,587,968. In Eureka, Calif., Mad River water supply project was bid in for $774,699, by **United Concrete Pipe Corp.**, of Los Angeles. Contract for cut-off trench and caissons at Lackawack dam in Ulster County, N. Y., went to the **Triest Contracting Co.**, of New York City, $737,777.

Sewers

Storm water sewer in Brooklyn, N. Y., is being built for $1,627,948, by **P. Tomasetti Contracting Co.**, of Brooklyn. Successful bidder for Tallmans Island sewage works, New York City, was **North Eastern Construction Co.**, of New York, with a price of $1,303,064. A $1,251,340 sewer contract in Brooklyn, N. Y., was awarded to **Luang Construction Co.**, of Brooklyn. Construction has started on a $977,912 sewer contract in Long Island City by **C. F. Vachris**, of Brooklyn, N. Y. In Pittsburgh, Pa., **Pittsburgh-Des Moines Steel Co.** is building a $372,206 incinerator plant. Low bidder for sewage plant in Lansing, Mich., was **Patterson Engineering Co.**, of Detroit, with a price of $326,713. In Hartford, Conn., **F. H. McGraw & Co.**, of New York City, received a $459,950 contract for portion of sewage treatment plant.

Highways

Among important state highway contracts awarded last month were the following: New York, $714,784 in Queens County to **Johnson, Drake & Piper**, of Freeport; $258,144 in Westchester County to **A. E. Ottaviano, Inc.**, of Croton-on-Hudson. Mississippi, $307,939 in Madison County to **Hodgkins Adams Co.**, of Winchester, Ky; $259,256 in Kemper County to **Cobb Bros. Construction Co., Inc.**, of Meridian, Miss.; $288,646 in Lowndes County to **Ruth Bros.**, of Georgetown, Ky. Kentucky, $444,081 in Jefferson County to **L. L. Clymer**, Bluffton, Ohio. Pennsylvania, $314,310 in Allegheny County to **Cable Co.**, of Canton, Ohio; $428,425 in McKeesport, to **Freeland, Inc.**, of Pittsburgh; California, $646,028 in San Luis Obispo County to **Metropolitan Construction Co.**, of Los Angeles. South Carolina, $258,119 in Greenville County to **Carolina Contracting Co.**, of Columbia, S. C.; $366,889 for bituminous paving at Anderson, S. C., to **C. G. Fuller**, of **Barnwell and Hardaway Construction Co.**, of Columbus, Ga. Missouri, $534,829 in St. Louis County, to **Clark, Kearney & Stark** and **R. B. Potashnick**, of St. Louis. Connecticut, $273,-418 in Greenwich, to **A. L. Savin Construction Co.**, of East Hartford. Wisconsin, $254,540 in Iron County to **Kileen Construction Co.**, of Superior. Texas, $312,851 in Jefferson County to **R. Mitchell**, of Houston. Arkansas, $256,397 in Union County to **D. F. Jones Construction Co., Maine**, $208,717 in Bowdoin County to **Lane Construction Corp.**, of Meriden, Conn. Colorado, $232,452 in Logan County to **E. Selander**, of Greeley.

Bridges

One of the contracts for a bridge over Mississippi River at Baton Rouge, La., was figured at $2,421,980 by **Kansas City Bridge Co.**, of Missouri. Bids on other contracts for this project were: $3,705,855 from **Bethlehem Steel Co.**; $598,320 from **Uvalde Construction Co.**, of Dallas, Tex.; $1,634,363 from **Steel Construction Co.**, of Birmingham, Ala., for tower piers and anchorage foundations for Bronx-Whitestone bridge, New York, a low bid of $1,893,558 was submitted by **Frederick Snare Corp.**, of New York. In Baltimore, Md., **Kaufman Construction Co.** bid $1,270,440 for approaches and underpass of Howard St. bridge. An $860,568 Connecticut River bridge contract went to **Daniel O'Connell's Son Co.**, of Holyoke.

Dams

At Cap au Gris, Mo., a $2,780,609 contract for dam No. 25, Mississippi River, was awarded to **United Construction Co.**, of Winona, Minn. Low bidder on Keystone dam at Keystone, Neb., was **Morrison-Knudsen Co.**, of Boise, Idaho, **General Construction Co.**, of Seattle, Wash., and **Utah Construction Co.**, of Salt Lake City, with a price of $2,735,667. For rolled fill portion of Sardis dam in Mississippi, **Hopper Construction Co.**, of Bunnell, Fla., received a $670,695 contract.

Miscellaneous

Low bidder for bulkhead wall, sewer construction and dredging in New York City was **Raymond Concrete Pile Co.**, of New York, with a price of $4,094,529 for three sections; for two other sections of same project low bid of $2,330,222 was received from **Frederick Snare Corp.**, of New York; for three more sections of same project, **W. P. McDonald Construction Co.**, of Flushing, N. Y., bid $4,433,473.

Low bid for river tunnels and shafts of Queens Midtown Tunnel, New York, amounting to $24,763,515 was received from **Walsh Construction Co.**, of Syracuse, N. Y. A $6,959,596 contract for section of Sixth Ave. subway, New York, went to **Spencer, White & Prentis**, of New York.

The "How" of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

How SUBMARINE PIPE LINE was launched along inclined ways carried by pontoons. — p. 41

How PIPE JOINTS, electrically welded, were reinforced by couplings between sections. — p. 41

How FLOW OF WATER into canal headworks is controlled by big cylindrical gates. — p. 42

How SMALL CONCRETE CREW produced big yardage for dam. — p. 44

How PLANT LAYOUT was designed for building concrete dam by cableway, — p. 45

How MOTOR TRUCK TRESTLE permitted dumping directly into live aggregate piles. — p. 45

How TAIL TOWER of cableway was operated by remote control. — p. 46

How BULK CEMENT was handled by special 150-sack trailer units. — p. 47

How DREDGING is used to form 400-acre island for exposition site. — p. 51

How "CAT'S WHISKERS" remove static electricity from motor cars on toll bridge. — p. 53

How CONSTRUCTION DETAILS can be applied to produce good concrete pavement. — p. 54

How TIMBER EXTENSION on truck-crane boom aided concrete placement. — p. 58

How PAVEMENT JOINTS were cleaned by motor exhaust blower. — p. 58

How CAMP BUILDINGS were kept cool by simple home-made air conditioner. — p. 58

How KNOBS ON ROLLER helped bond asphalt surface to concrete pavement base. — p. 59

How PORTABLE SCREEN, on crawlers, prepared embankment material for dam. — p. 59

How BUCKET GRADER prepared road base. — p. 59

How WELDED BRACKETS supported scaffold for dam. — p. 59

How TRUCK MAINTENANCE and repair was aided by elevated inspection rack. — p. 59

How "STRADDLE LINE" regulated highway traffic and prevented accidents. — p. 59

How SPECIAL FOUNDATIONS and large pier caissons are built by modern methods. — p. 64

How OIL ENGINES of electric ignition type are best operated and maintained. — p. 68

How WOOD BARREL supported floating bridge. — p. 70

How PUMPED CONCRETE was delivered to industrial plant covering large 800,000-sq.ft. area. — p. 71

ROBERT K. TOMLIN, Editor — WILLARD CHEVALIER, Vice-President

Editorial Staff: Vincent B. Smith, John B. Huttl (San Francisco), Paul Wooton (Washington), Nelle Fitzgerald

McGraw-Hill's New President

EFFECTIVE June 21, James H. McGraw, Jr. was elected president of the McGraw-Hill Publishing Co. to succeed Malcolm Muir, resigned. Mr. McGraw, Jr. continues as chairman of the board and assumes the additional responsibilities of the office of president.

Following his graduation from Princeton University in 1915, Mr. McGraw entered the service of the company and for twenty-one years has served actively in various posts connected with its publishing activities. After eight years of service with individual papers and groups of papers, he entered the general management of the company as treasurer in 1923, and became executive vice-president in 1932. In 1935 he was elected chairman of the board to succeed James H. McGraw, founder of the company.

In 1932 and 1933, Mr. McGraw served as president of the Associated Business Papers and in addition to his work in his own company he has contributed generously of his time and effort to the advancement of business paper publishing. Thoroughly grounded in the editorial tradition, he has applied himself aggressively to keeping the business paper abreast of what is best in modern publishing practice from the viewpoint of both readers and advertisers.

In the development of CONSTRUCTION METHODS AND EQUIPMENT Mr. McGraw has always taken a close and constructive interest and it was largely due to his initiative and encouragement that the paper was redesigned and expanded to its present form.

Willard Chevalier

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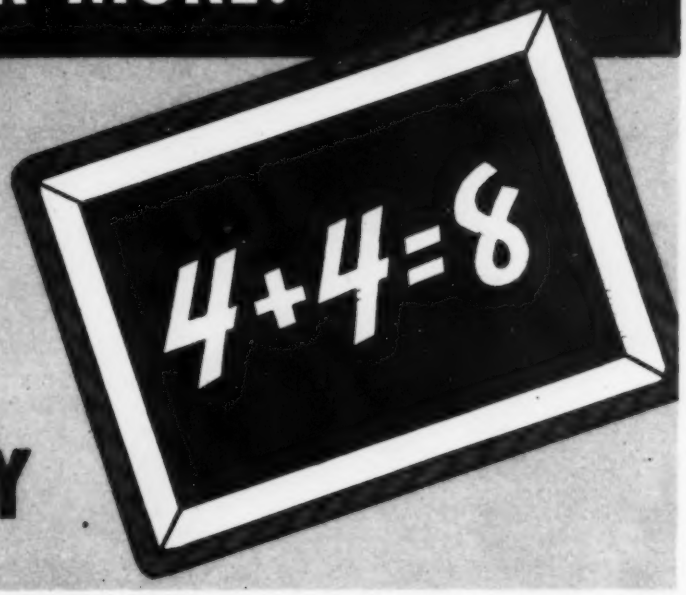
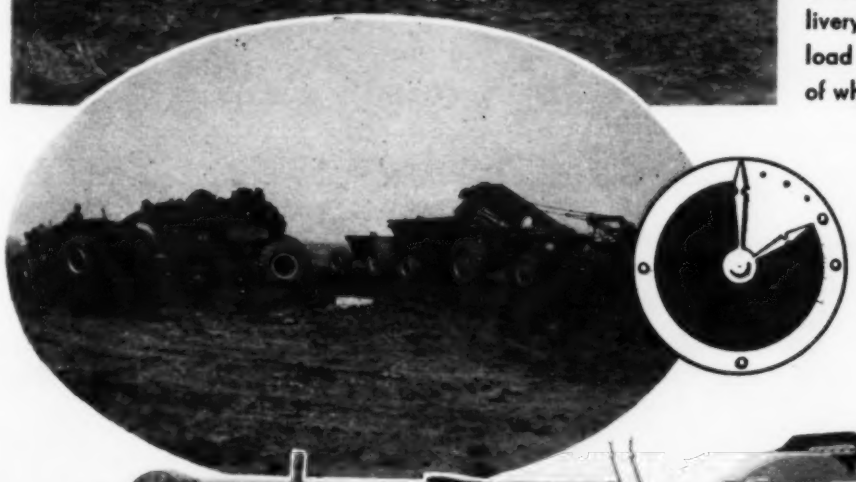
Again prove their LOWER COST ECONOMY



PURCHASE of these Four and Four More was the result of this contractor's selection after witnessing comparative merit of competitive hauling equipment on their own work. And the same surpassing performance that influenced this discriminating buyer continues on Kansas road-work where the fleet of Eight Units is in daily use. What Trac-Truks have is more of what it takes to render satisfactory service with their high-powered delivery—greater carrying capacity—faster travel speed—ease of load flotation and incomparable saving in dumping time—all of which means more production at lower unit cost.



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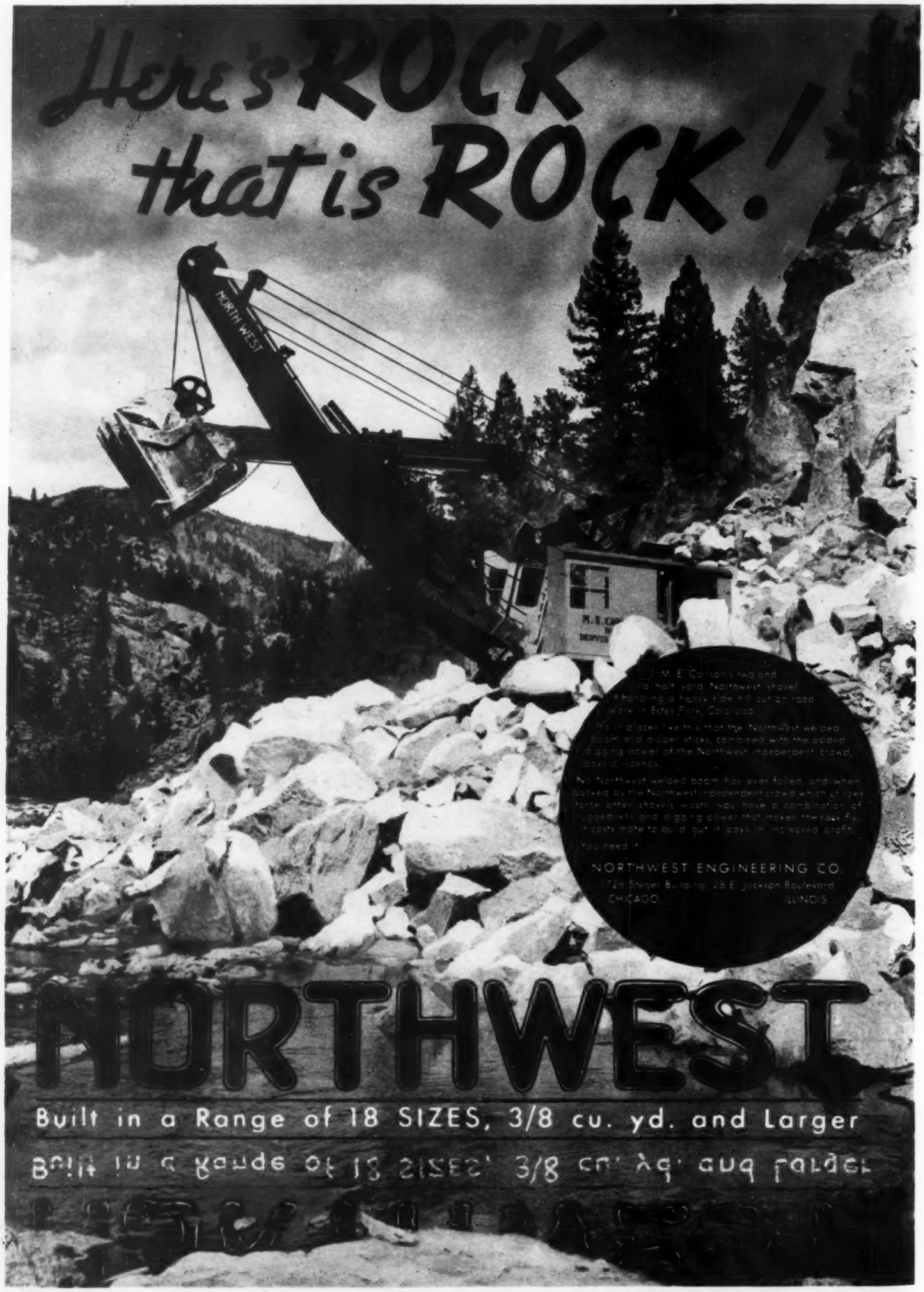
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WITH WATERTIGHT CONCRETE

MONKEY ISLAND (above) is year-around home of Chicago Zoo's Rhesus monkey colony. Sandstone crags, beaches and trees make a picturesque outdoor setting. Retiring houses, concealed in the rock-work, electrically heated and ventilated, provide cozy winter quarters.

The Rhesus monkey, hailing from North India and South China, is a great swimmer and diver. Hence, the water-filled moat which surrounds the island. The moat's concrete walls are 18 feet high, water is 14 feet at greatest depth. Outside moat dimensions, 180'x 130'.

To be sure of getting watertight concrete, Edwin H. Clark, Chicago architect, specified 'Incor' 24-Hour Cement. John E. Ericsson Company, general contractors, obtained thoroughly-cured concrete in 48 hours—instead of 10 days with ordinary concrete.

No "monkey business" with concrete like this. Workability is secured, not by adding excess water, but by proper mix design — made easier by 'Incor's smoother-working properties. And thorough curing is next thing to automatic — 8 days less than ordinary concrete.

That is why 'Incor' is fast coming to be standard practice among architects, engineers and contractors who appreciate the time and money saving and greater assurance 'Incor'* affords. Write for copy of "Watertight Concrete." Lone Star Cement Corporation, Room 2295, 342 Madison Avenue, New York.

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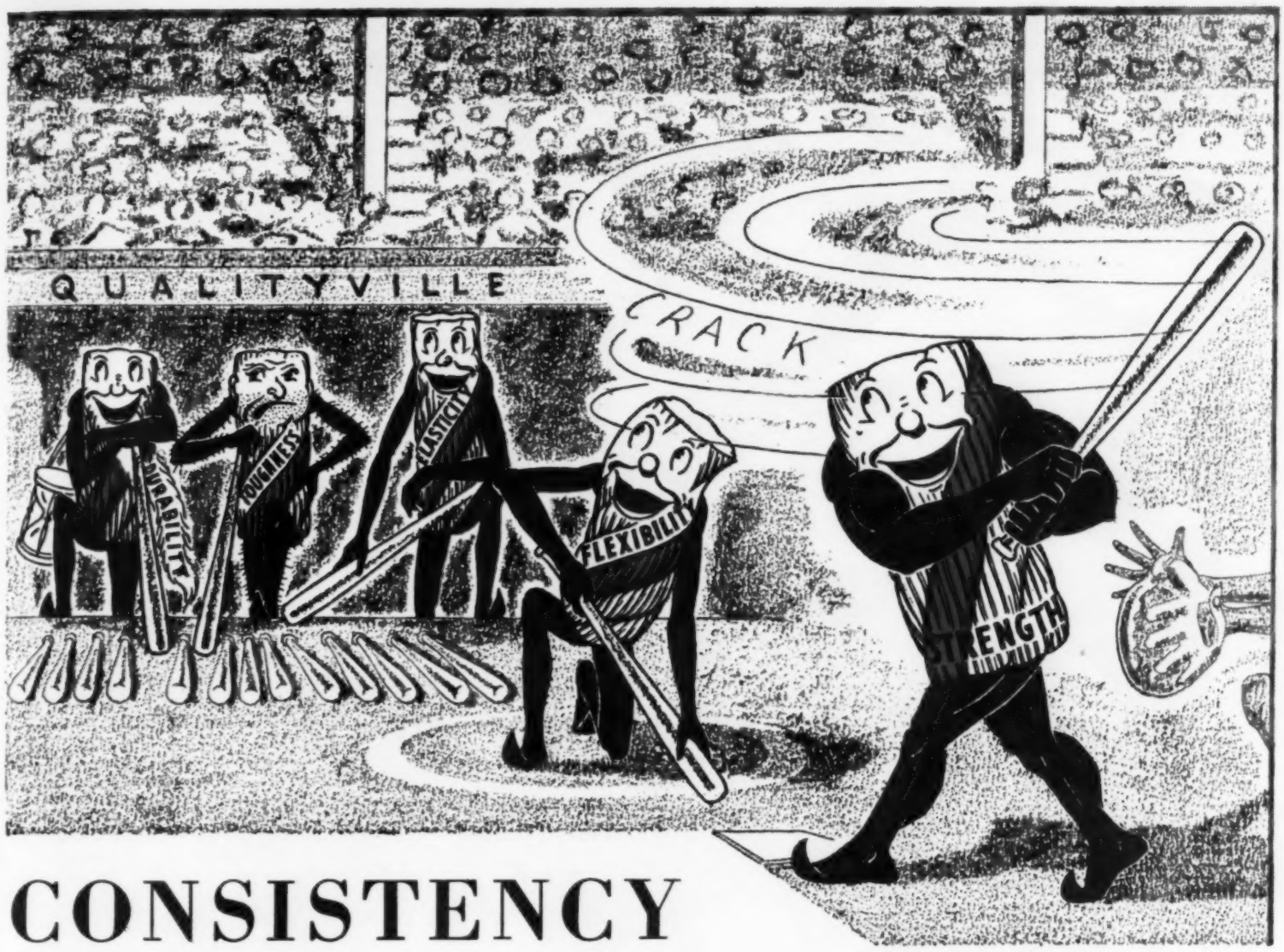

CONSISTENCY Wins Ball Games

A consistent ball team composed of good pitchers, reliable hitters, and a well balanced crew in the field is the kind that hoists the championship pennant at the end of the season.

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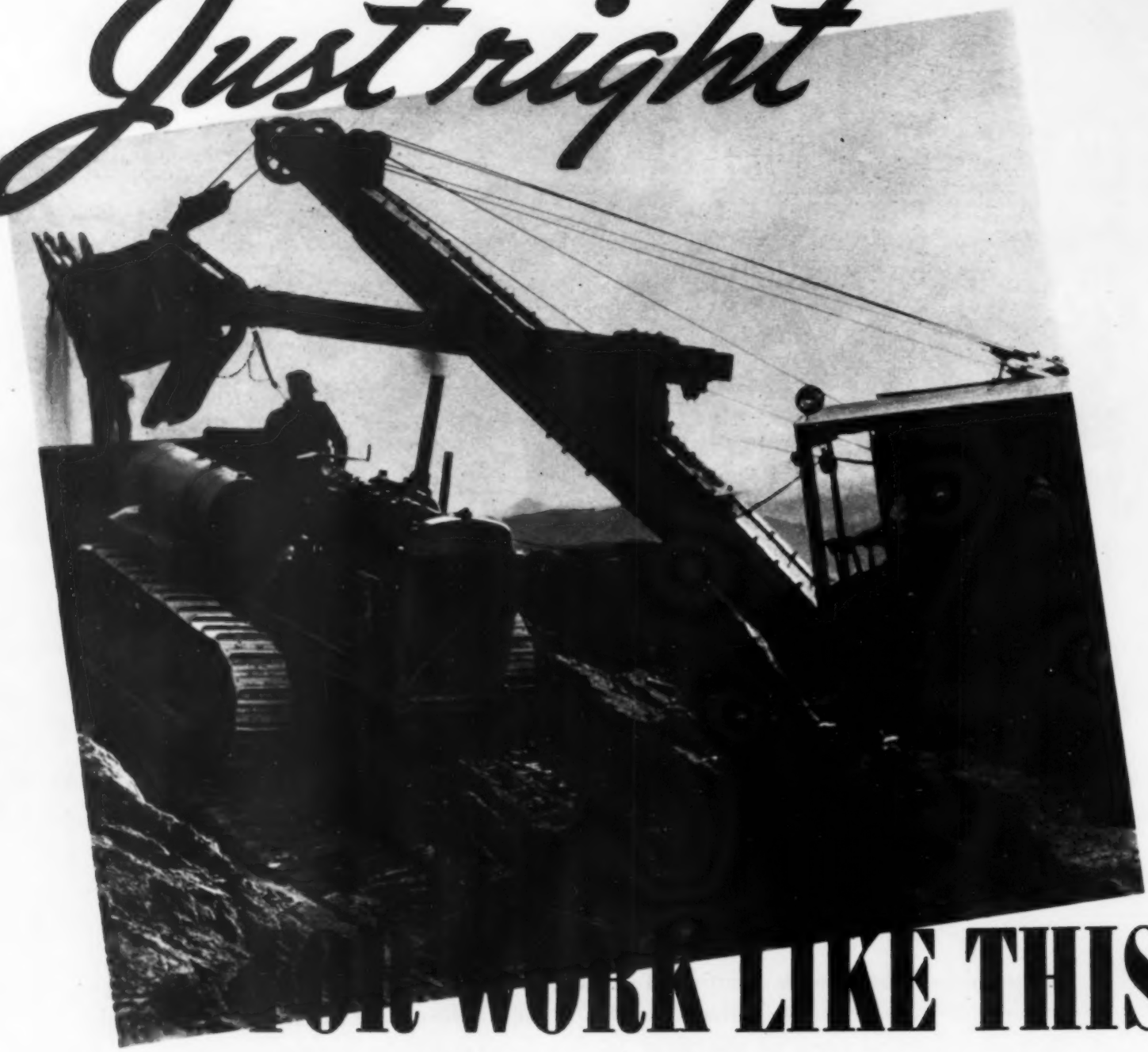

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NOVO in the NEWS

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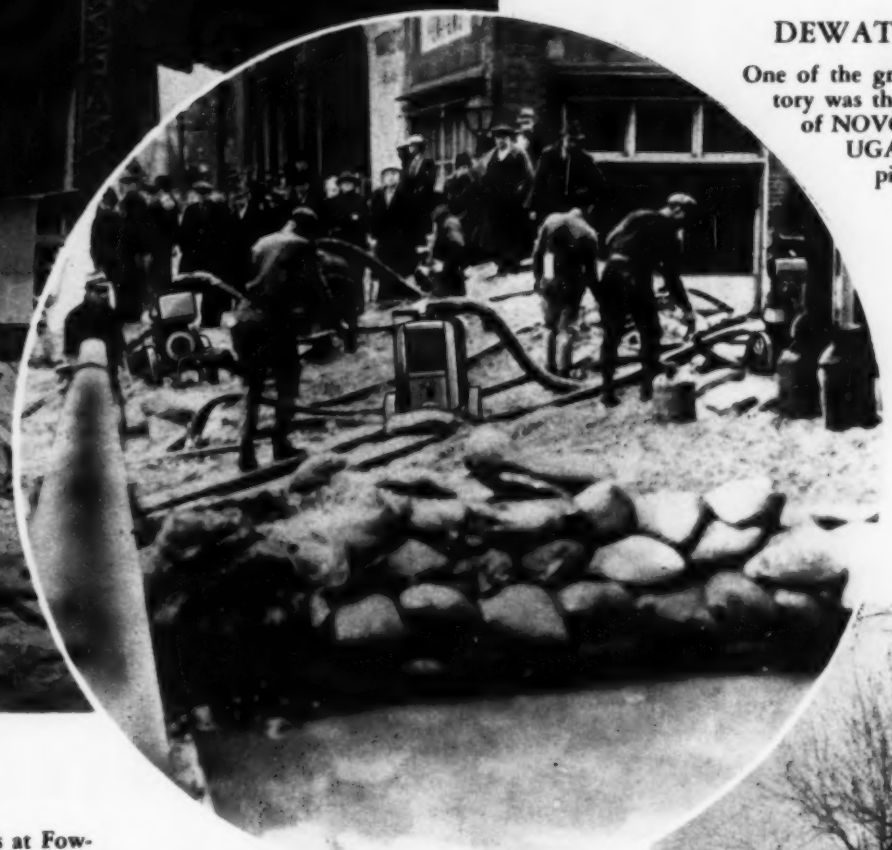

DEWATERING PUMPS

One of the greatest de-watering jobs in history was the Ohio River flood. Hundreds of NOVO SELF PRIMING CENTRIFUGAL PUMPS (5 shown in this picture) were used on this de-water job to save lives and property at Cincinnati. Pumps operated night and day. Workers explained their effectiveness was due to the large, adequate power units and the long life seals which kept these pumps on the job.

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With two men, this breaker is shifted quickly from place to place, breaking out a curb here, a strip of pavement there and cutting a smooth trench in the concrete to be left in place. The surprisingly low cost figures on this method of breaking makes important news to contractors.

WRITE FOR LITERATURE

on these various pieces of equipment. There is also a line of pressure and diaphragm pumps, light plants and drag-line hoists.

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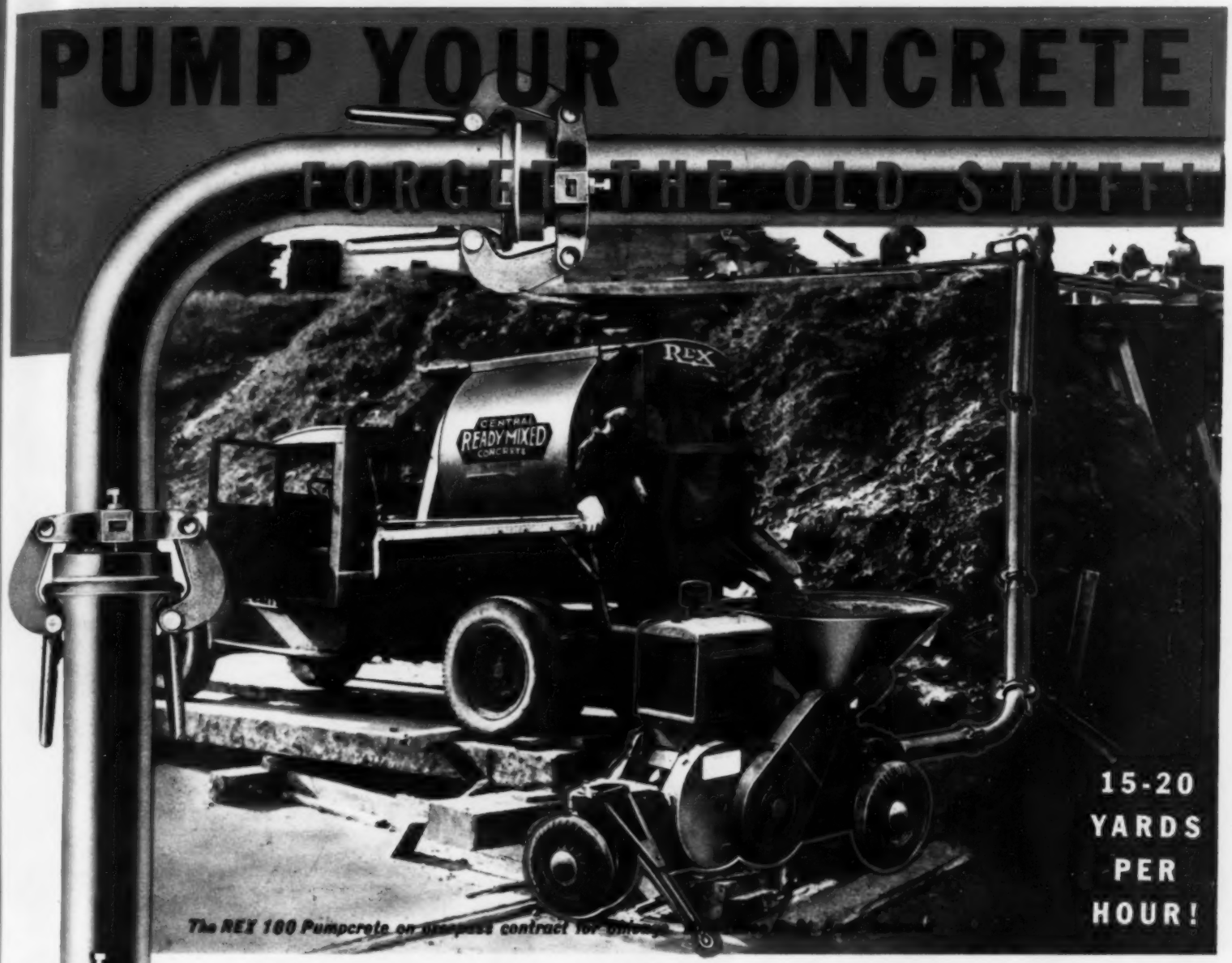

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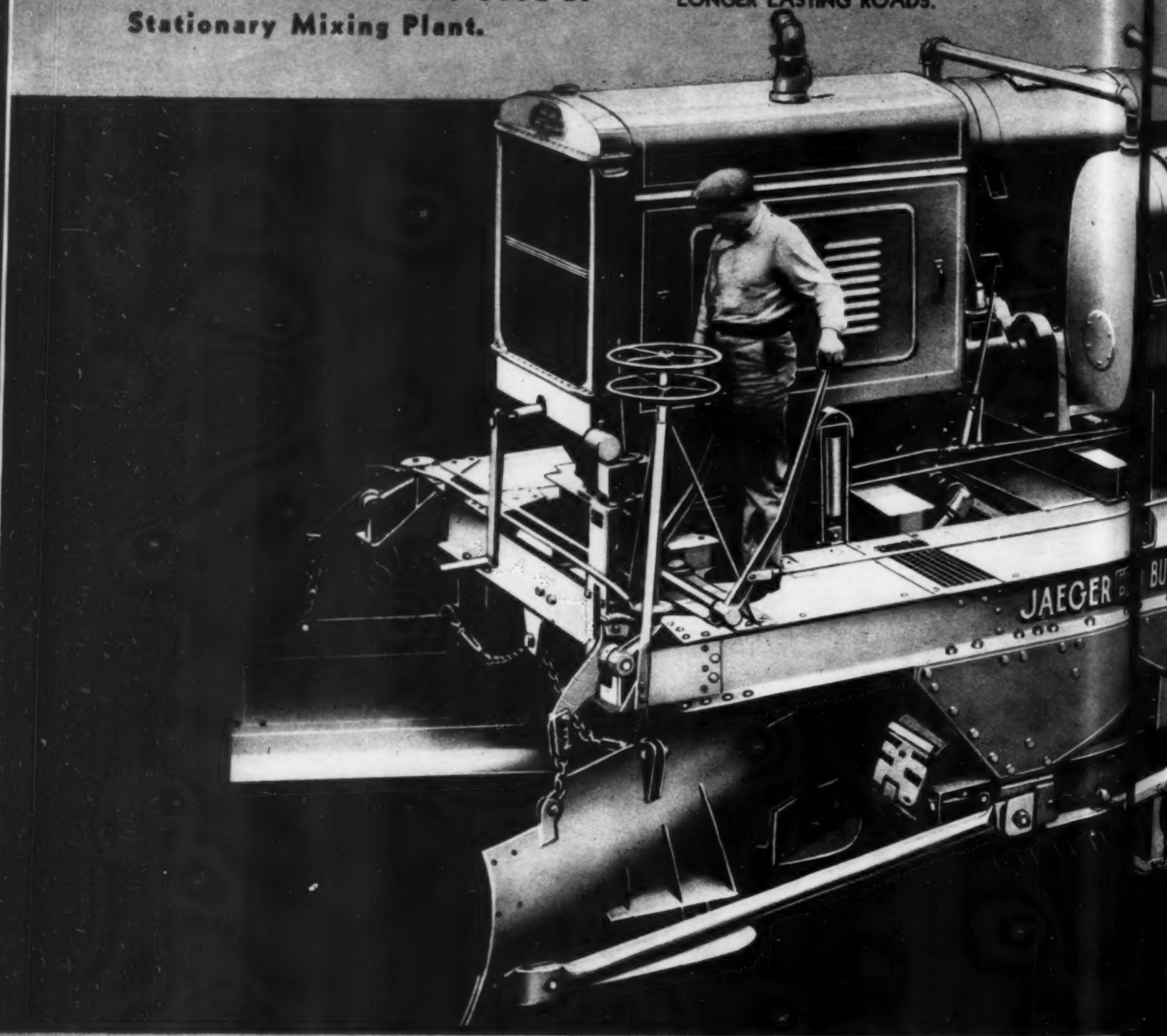

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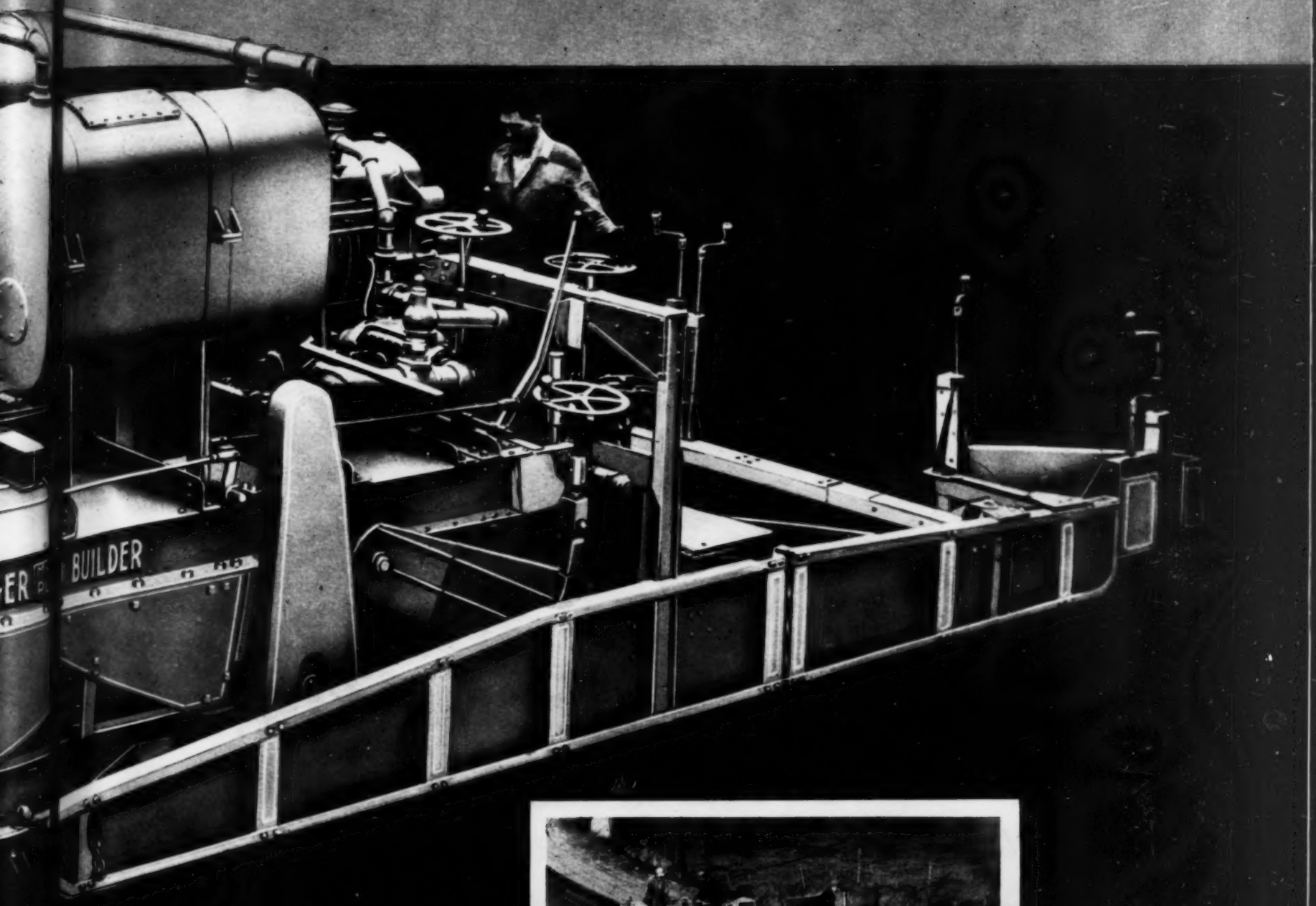

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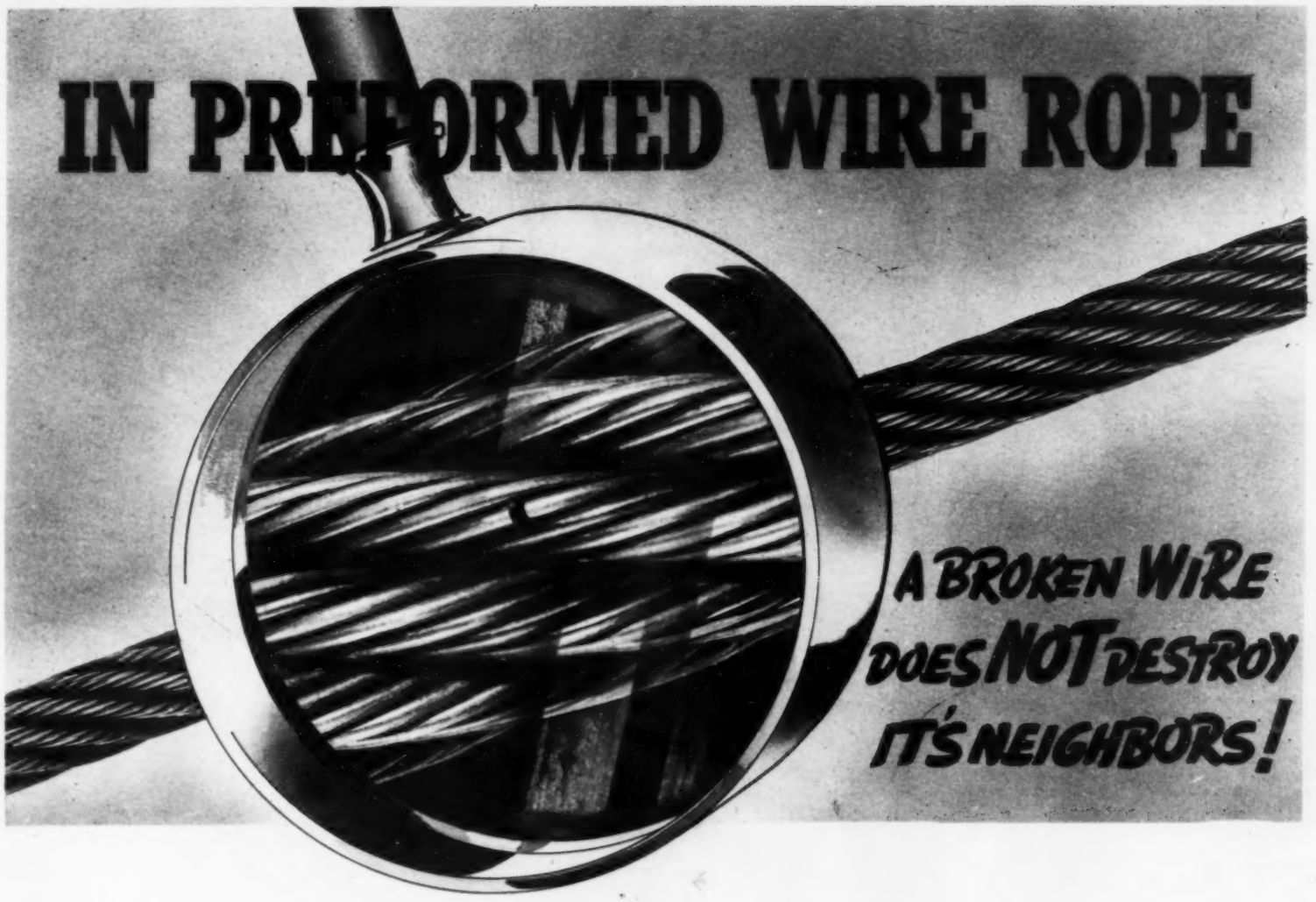
CUMMINS *Dependable* DIESEL

PIONEER IN MODERN DIESEL DEVELOPMENT



Select the Rope that Fits Your Job

Protruding wires lap over adjacent wires as a wire rope passes over a sheave thus nicking the adjacent wires and causing rapid destruction of the rope. A broken outer wire in a preformed rope remains in its normal position. A broken outer wire in a non-preformed rope has a decided tendency to protrude. In cases where safety factors permit the continued use of a rope with a few broken wires, the additional service of the preformed rope after the first broken wires appear will in itself warrant the additional cost. Write us about your use of wire rope and we will gladly tell you whether or not preforming will save you money.

•

WICKWIRE SPENCER STEEL COMPANY, *General Offices:* 41 East 42nd Street, New York. *Sales Offices and Warehouses:* Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles; *Export Sales Dept.:* New York.

WICKWIRE SPENCER SALES CORPORATION, New York, Chattanooga, Tulsa, Portland, Seattle.

WIRE ROPE
by Wickwire Spencer

WICKWIRE SPENCER STEEL COMPANY
41 East 42nd St., New York City
Please send me my free copy of your popular, new money saving manual, "Know Your Ropes".

Name_____

Firm_____

Address_____

City_____ State_____

DESERT DUST CAN'T STOP THE DIESELS!

WORLD'S CHEAPEST DIRT-MOVING. This combination of "Caterpillar" Elevating Grader and Diesel Tractor moved a tremendous yardage of desert dust—on 32 cents' worth of Diesel fuel per hour!

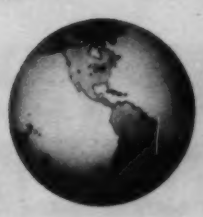
FINISHING THE GRADE—TO THE INCH
Sure, fine control features this "Caterpillar" Power-controlled Blade Grader, pulled by one of the four "Caterpillar" Diesel Tractors on this project.

MAKING THE FILL. Long on power and short on cost—this Diesel Tractor and LeTourneau Bulldozer moved big payloads to the fills—left the roadbed ready for finishing.

STRAIGHT across 196 kilometers of the dry, burning Sonora Desert in Mexico, these "Caterpillar" Diesel Tractors built a railroad bed to give Arizona products an outlet to the sea. Scores of miles from water, parts and service—working in penetrating dust under terrific temperatures, the Diesels put through the job in record time—and at the lowest cost per mile.

At 115° above or 60° below—in desert or swamp—"Caterpillar" Diesel Tractors and Graders are built to produce, regardless of conditions. Look at the records they've made in every section of the country—and have a "Caterpillar" dealer show you what they offer for your work.

CATERPILLAR TRACTOR CO.
REG. U.S. PAT. OFF. PEORIA, ILL.



WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES, TRACK-TYPE TRACTORS AND ROAD MACHINERY

Trim Your Costs with LaPlant-Choate BULLDOZERS

Designed Right! Built Right!

Here's a rugged, easy-to-operate Bulldozer that is not limited to just a few types of earth moving jobs. LaPlant-Choate Bulldozers will efficiently and economically handle virtually any job you may encounter from small leveling work to extensive and difficult major projects! Hydraulic control makes operation simple and easy as well as absolutely dependable. Constant down pressure, if required, positive locking of blade in one position, easy removal to free tractor for other uses, freedom from overhead obstructions, an absolute minimum of wearing parts, and reliable, finger-tip hydraulic control are but a few features of the famous LaPlant-Choate Bulldozer that will save you time and money on your jobs.

These Bulldozers are built exclusively for use on "Caterpillar" track-type tractors — assuring balanced, efficient performance. With LaPlant-Choate equipment you are also assured of the same super service facilities as afforded you on "Caterpillar" track-type tractors by the same dealer organization in every territory. Trouble-free and sturdy, LaPlant-Choate Bulldozers will enable you to do better work at lower cost.

Get complete information today. Your nearest "Caterpillar" dealer can supply you with full details or write direct to us. There is no more completely satisfactory Bulldozer on the market!

ROAD BUILDERS • SCRAPERS • TAMPING ROLLERS • RUBBER WHEELED WAGONS • BRUSH CUTTERS • SNOW PLOWS

LaPlant-Choate Mfg. Co. Inc.
CEDAR RAPIDS, IOWA

YES, WE CAN DIG A DITCH

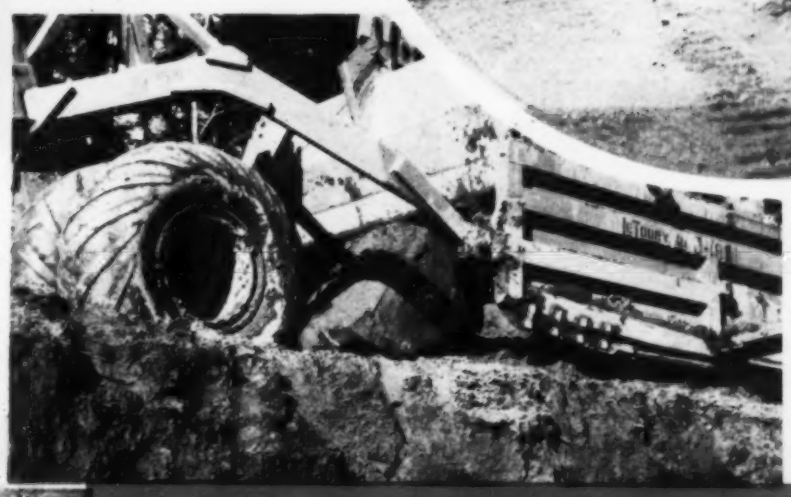
or Rip Old Pavement
or Cut a Trail
or Work Tandem
or Load Rock

If you're a "doubting Thomas" take a look at these pictures. Then ask your "Caterpillar" dealer to show you what LeTourneau equipment is doing right in your own "neck of the woods." You'll soon see that on job after job, LeTourneau equipment is moving the earth at lower costs and quicker than is possible by any other method. You will see, too, that it handles a score of extra jobs that ordinarily require expensive extra equipment. You profit two ways when you use LeTourneau rigs—by their ability to move the earth and by their versatility. Ask your "Caterpillar" dealer to demonstrate.

LeTourneau 12-Yard Carryall cutting a drainage ditch on a Texas highway job.

LeTourneau Rooter, with one standard removed, ripping up old asphalt on a Missouri realignment project.

Cutting a trail in a hillside over which heavier equipment will go to work. LeTourneau Angledozers are much used for such pioneering work.



LeTourneau U-18 Carryall unloading a boulder 2 cubic yards in size on a Michigan road job. The high apron lift (42 inches on the U-18) of LeTourneau Carryall Scrapers easily passes boulders and chunky material.

New Zealanders put a tandem hookup and LeTourneau 12-Yard Carryalls to work on an airport project, thus greatly increase yardage output per tractor and at the same time materially lower costs.

R. G. LE TOURNEAU, INC.

Peoria, Illinois — Stockton, California

Cable address: "Bobletorno"

Manufacturers of: Angledozers, Buggies,* Bulldozers, Carryall* Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters,* Treedozers.*

** Name registered U. S. Patent Office.*

LETOURNEAU

BIGGEST item in tunnel driving costs is labor. And that's just where "Ventube" proves its economy . . . by speeding up work and reducing man-hours.

Du Pont "Ventube" can be handled with amazing ease and speed. It is hung from support wires quickly strung. During blasting, the section closest to the blasting face telescopes back on itself easily and quickly. More time is saved by the rapidity with which it can be thrown up to the working face after blasting to exhaust gases and permit a quicker return to work by the shift. When the job is finished, "Ventube" is removed from the supporting wire, rolled up and easily carried away for the next job.

It is significant that where world's records have been set in tunneling operations, as on the Los Angeles water supply project and the Twin Lakes project, du Pont "Ventube" has been used.

Jute "Ventube" is made of extra heavy, long fibered Hessian cloth impregnated and coated with rubber. It's as strong in tear resistance in the warp direction as in the filler. There are no vulnerable weak spots to rip or tear.

Try a few sections of "Ventube" leading up to the working face and convince yourself of its strength and ease of handling.

DU PONT

THE FLEXIBLE VENTUBE VENTILATING DUCT

REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., INC.

"FABRIKOID" DIVISION FAIRFIELD, CONNECTICUT

GIVE YOUR YARDAGE A BOOST —WITH ATHEY FORGED-TRAK 16-YARD 2-WAY DUMP TRAILERS

THE EASIEST RUNNING ALL-WEATHER LOAD-CARRYING WHEEL!

When you're out to move more dirt . . . sand . . . rock . . . in shorter time, don't stop with "half-way" hauling equipment. Go *all the way* to greater production and profits with Athey Forged-Trak 16-Yard 2-Way Dump Trailers. Here are the big capacities you need—capacities that mean more yardage moved with fewer trips. Here are *all-weather* 30-Ton Athey Forged-Trak Wheels with the large supporting area that enables them to climb obstructions . . . get over any kind of ground with minimum tractive effort. No wonder so many engineers and contractors are turning to Athey Forged-Trak hauling units! Used with "Caterpillar" Diesel Tractors, these units assure faster schedules, without "ifs" or "maybes." See your "Caterpillar" Dealer or write us.

Steel wheels on *Steel* rails, running on a *Steel* roadbed—it's the combination that takes the delays out of hauling—gives you more yards per gallon of fuel—moves more material per trip.

ATHEY TRUSS WHEEL CO.
5631 West 65th Street
Cable Address: "Trusswheel," Chicago
Chicago, Illinois

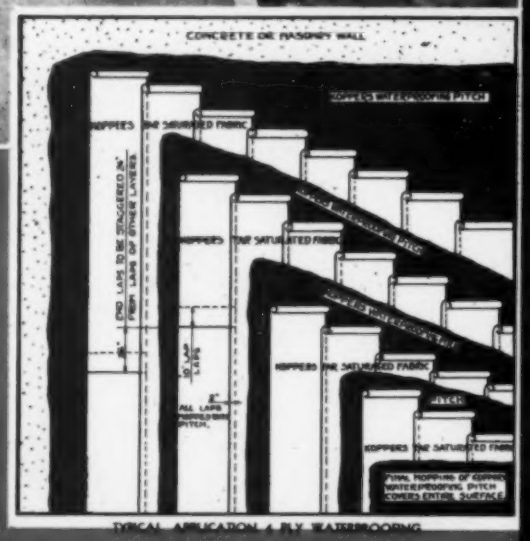
ATHEY
Forged-Trak
(REG. TRADE-MARK)

2-WAY DUMP TRAILERS
Capacities from 10 to 16 Yards

KOPPERS

WATERPROOFING ON BRIDGE DECKS

ADDS YEARS TO BRIDGE LIFE


CONCRETE OR MASONRY WALL
KOPPERS TAR SATURATED FABRIC
KOPPERS TAR SATURATED FABRIC
KOPPERS TAR SATURATED FABRIC
KOPPERS TAR SATURATED FABRIC
FINAL MOPPING OF KOPPERS WATERPROOFING PITCH COVERS ENTIRE SURFACE

TYPICAL APPLICATION 4 PLY WATERPROOFING

Many of the troubles which develop in concrete or masonry bridges are traceable to the absence of waterproofing, or the use of inadequate types of waterproofing.

Koppers Membrane Waterproofing will prevent the passage of water through highway and railroad bridge decks, and elevated highways. It will also prevent the disintegration of masonry and concrete walls, abutments and other structures.

Koppers Membrane Waterproofing is constructed in place by mopping plies of Koppers Tar-Saturated Open Mesh Cotton Fabric or Koppers Approved Tarred Felt with Koppers Waterproofing Pitch, as shown in the diagram on this page.

Where the exposure is less severe, Koppers Dampproofing is sometimes recommended. Send for the Koppers booklet on waterproofing and dampproofing, or let us have an experienced Koppers waterproofing engineer go over your job with you.

Koppers Divisions, Subsidiaries and Affiliates Serving the Public Works Field

TAR AND CHEMICAL DIVISION
PITTSBURGH, PA.

THE WOOD PRESERVING CORPORATION
PITTSBURGH, PA.

NATIONAL LUMBER & CREOSOTING CO.
TEXARKANA, ARK.

WESTERN GAS DIVISION
FORT WAYNE, IND.

BARTLETT HAYWARD DIVISION
BALTIMORE, MD.

AMERICAN HAMMERED PISTON RING DIVISION
BALTIMORE, MD.

THE KOPPERS COAL COMPANY
PITTSBURGH, PA.

NEW ENGLAND COAL AND COKE COMPANY
BOSTON, MASS.

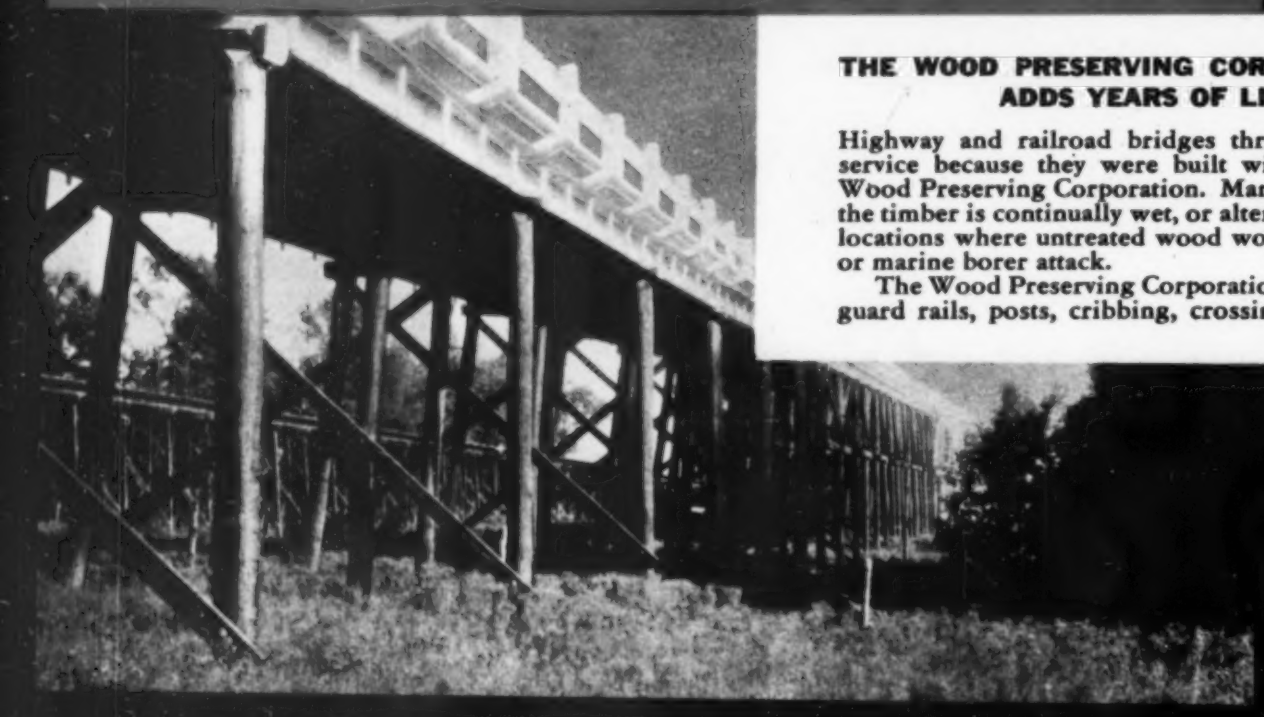
THE MARYLAND DRYDOCK COMPANY
BALTIMORE, MD.

THE WHITE TAR COMPANY OF NEW JERSEY, INC.
KEARNY, N. J.

●

Koppers Principal Products For the Public Works Field

American Hammered Piston Rings . . . Koppers D-H-S Bronze Castings . . . Iron Castings . . . Coal . . . Coal and Coke Testing . . . Coal Tar Roofing . . . Creosote . . . Dampproofing . . . Disinfectants . . . Insecticides . . . Fast's Self-aligning Couplings . . . Fire Hydrants . . . Gas Holders . . . Highway Marking Paints . . . Pipe . . . Pressure-treated Posts, Poles . . . Sluice Gates . . . Tanks . . . Tarmac Road Tars . . . Tarmac Handbook . . . Treated Timber . . . Waterproofing . . . Waterworks Gate Valves . . . Weed Killers



THE WOOD PRESERVING CORPORATION'S TREATED TIMBER ADDS YEARS OF LIFE TO THIS BRIDGE

Highway and railroad bridges throughout America are giving longer service because they were built with pressure-treated timber from the Wood Preserving Corporation. Many of these bridges are in places where the timber is continually wet, or alternately wet and dry, or in warm, moist locations where untreated wood would be subject to decay, or to termite or marine borer attack.

The Wood Preserving Corporation also supplies pressure-treated poles, guard rails, posts, cribbing, crossing planks and other wood products.

Koppers Will Make Tests of Your Coal and Coke

KOPPERS Tarmac

MIXED-IN-PLACE CONSTRUCTION OVER AN OLD NARROW BRICK ROAD

This type of surface is also an excellent method of leveling and strengthening rough pavements of any other type.

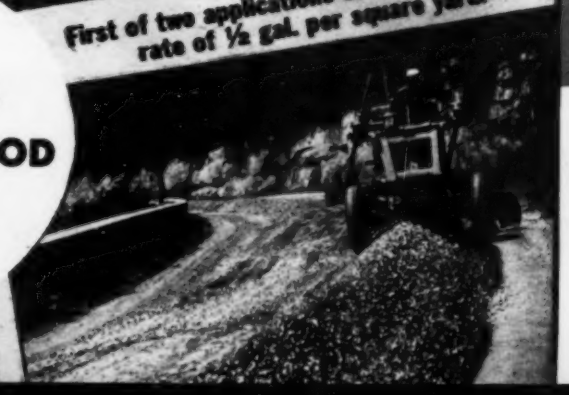
The old road, before treatment.

Widening each side of the original 14-feet with broken stone.

Eliminating the high crown and depressions in the road with wedge course of Tarmac A

Spreading slag for the mixed-in-place course.

First of two applications of Tarmac, each at rate of ½ gal. per square yard.



Rolling.

Completed Tarmac surface.

This photo shows section of this road in Washington County, Pa., later, undermined by flood. The Tarmac Mixed-in-place top adhered so tightly to the brick surface that it supported the brick when the base was washed away.

Send for your copy of the Tarmac Specification Sheet for Mixed-in-place Construction.

Tarmac MAKES GOOD ROADS

KOPPERS

KOPPERS COMPANY,
Tar & Chemical Division, Pittsburgh, Pa.

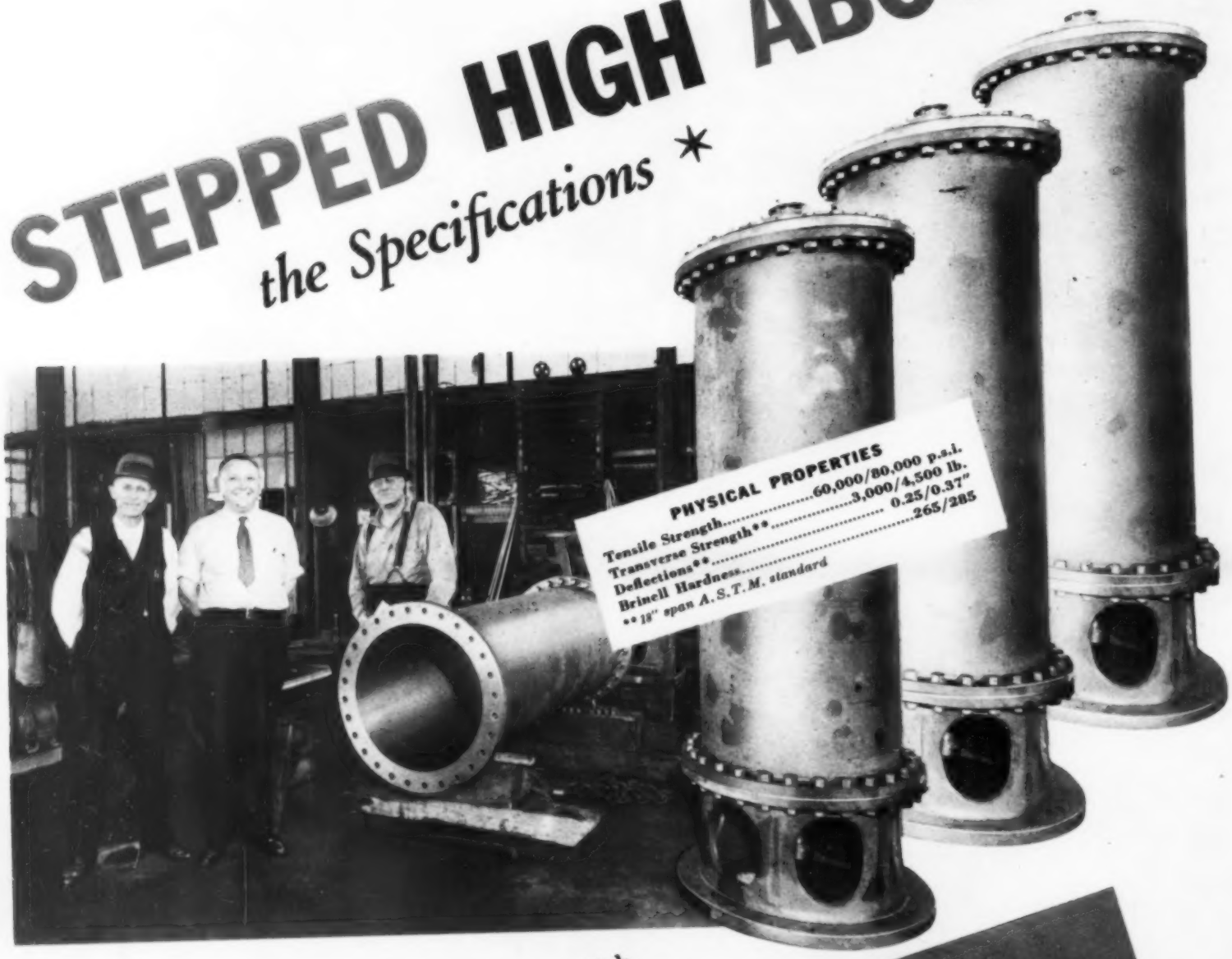
Please send me your specification for Tarmac Mixed-in-place Construction.

Your Name.....

.....

.....CM7

STEPPED HIGH ABOVE *the Specifications* ✶



PHYSICAL PROPERTIES

Tensile Strength	60,000/80,000 p.s.i.
Transverse Strength**	3,000/4,500 lb.
Deflections**	0.25/0.37"
Brinell Hardness	265/285

** 18" span A.S.T.M. standard

ALWAYS a step ahead of consumer demands for high strength cast irons is the up-to-date foundry with its knowledge of modern metallurgy and alloys.

The hydraulic cylinders shown here are 4 of the 9 recently cast by Madsen Iron Works, Huntington Park, Calif., for the Fairmount Reservoir, in California. Operated under high oil pressure . . . the required tensile strength was set at 50,000 p. s. i. So Madsen, using the Ni-Tensyliron[1] process turned out these 6½′ long, 26″ inside dia. castings with a tensile strength of 60,000-80,000 p.s.i. And a Brinell hardness of 265-285.

Moderate amounts of Nickel sometimes in combination with other alloying elements so improve density and evenness of grain structure that the resultant gain in strength, uniformity, machinability and wear resistance is achieved at small cost.

Consultation to find the correct alloy to meet your specific needs for these properties is invited.

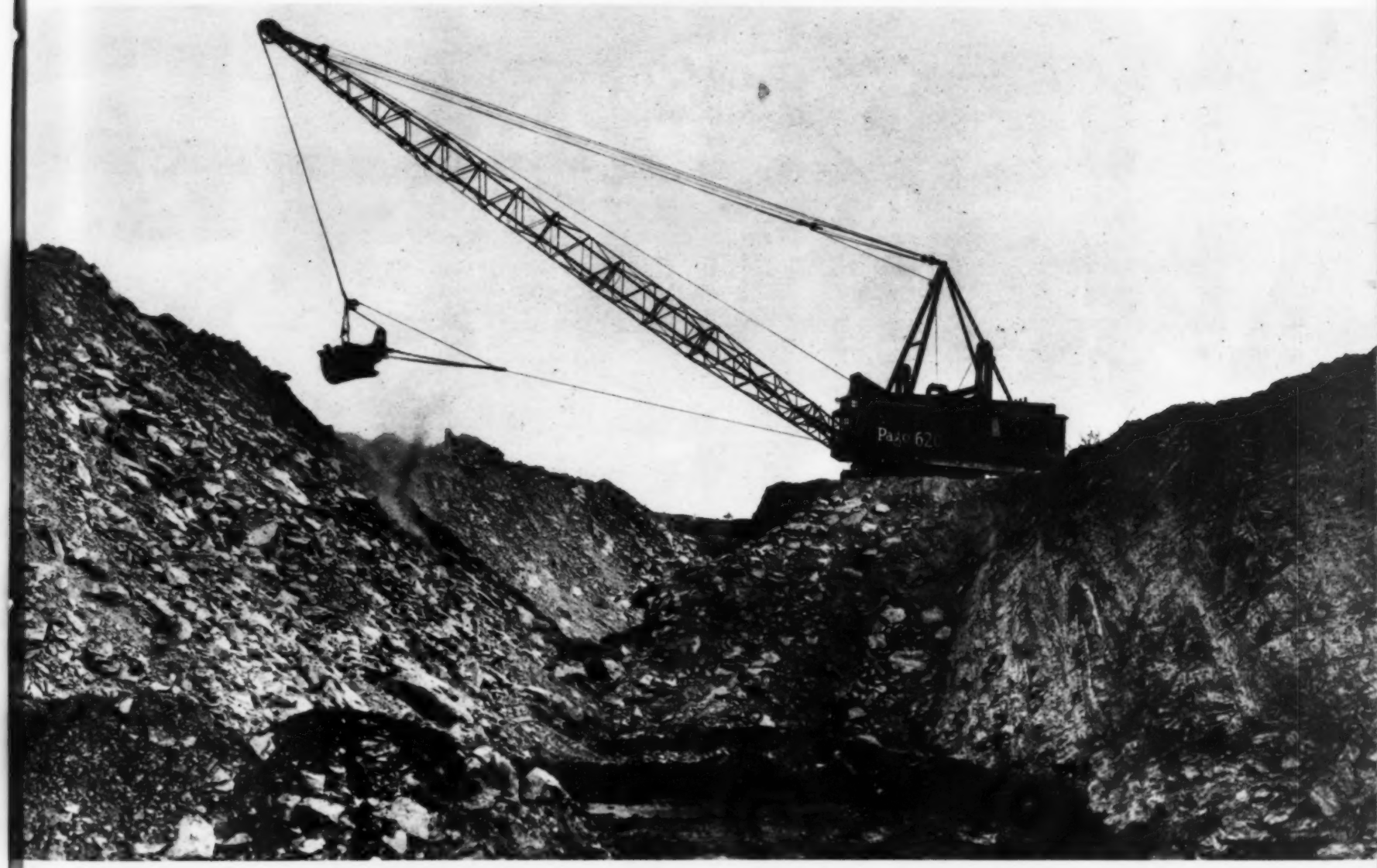
1 Reg. U.S. Pat. Off. by The International Nickel Company, Inc. Canadian Patent 324,552

✶ 50,000 p. s. i. was the minimum specification in tensile strength for these Hydraulic Cylinders.

NICKEL CAST IRONS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

HAVE YOU CONSIDERED A *Page Walking Dragline* FOR YOUR JOB?



High Yardage Draglines For All Classes of Excavation— Diesel Powered—3 Cubic Yard Capacity and Larger

Page Walkers in the series "600" are completely modern, rugged, dragline machines with fast load, hoist, and swing speeds for greater yardage 24 hours per day, month after month.

Also—because of the *large circular base* and the *positive crank action walking mechanism*, Page Draglines work on softer ground, move immediately in any direction.

If your job requires more yardage,—lower operating costs,—longer reach—and complete independence of weather conditions, investigate thoroughly the Page Walkers Series "600". Use the convenient coupon.

Page Engineering Co.

Clearing Post Office » » Chicago, Ill.

PAGE AUTOMATIC DRAGLINE BUCKETS
PAGE WALKING DRAGLINE MACHINES

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

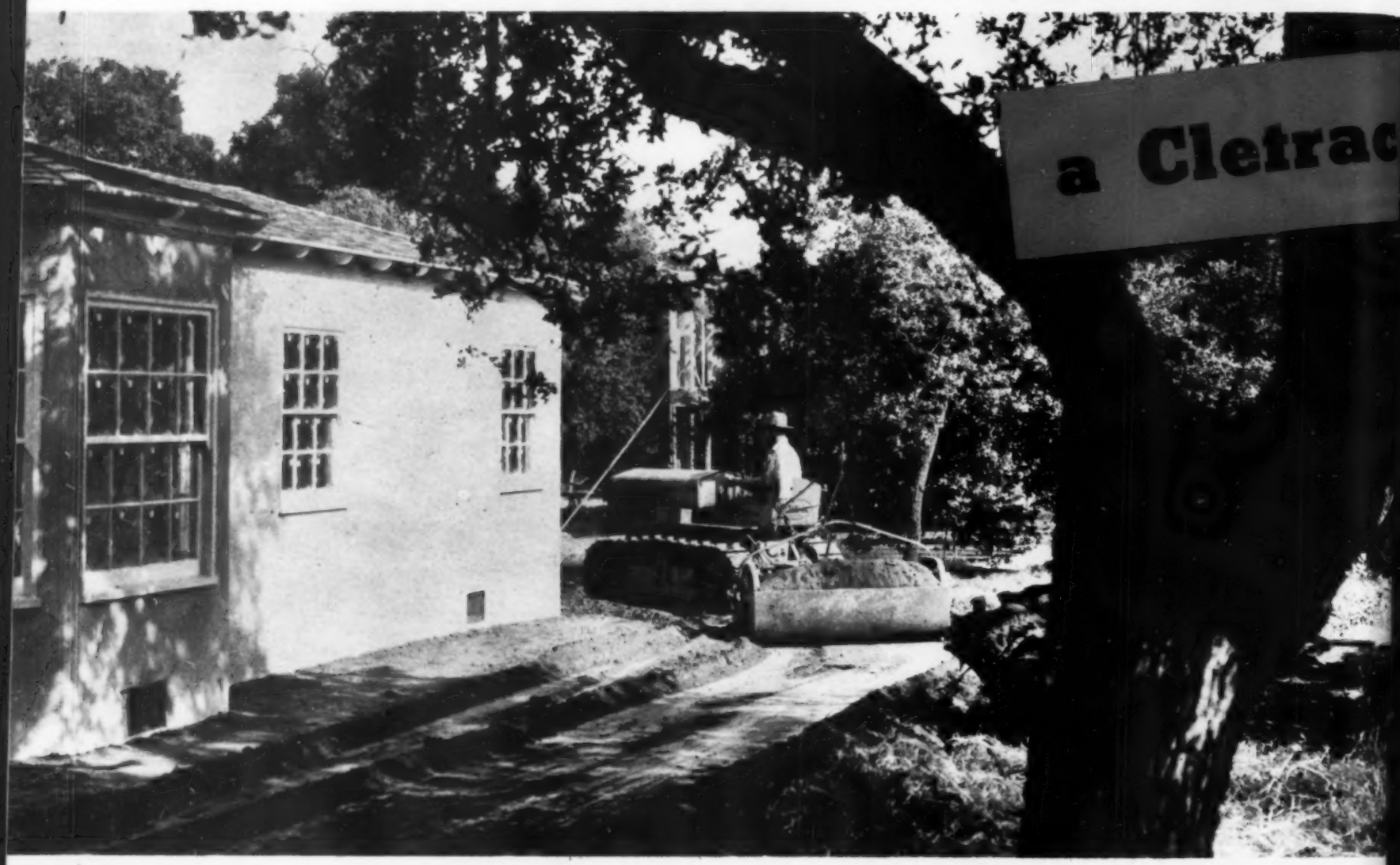
Please send information on a Page "600" Walker. Size _____

Name _____

Address _____

_____ *State* _____ "S

LITTLE JOB OR BIG



In April, 1936, George Glover, Pasadena, California, bought a Model AG for cellar and basement excavation. A year later, he bought another . . . his business was growing. In this 27 horsepower tractor, Mr. Glover is using only 1-¾ gallons of 11 cent gasoline per hour, pulling rippers and a 6-foot jumbo scraper.

These three Cletracs completed this 453,000 cubic-yard job in Oregon 45 days ahead of schedule. They averaged 12 trips per hour over a 1100 foot average haul with 12 yard scrapers. And . . . during the 276 days — 21 hours a day — they were on the job, the total down time was only 44 hours. Cletracs are built to take it.

Cletrac

Crawler Tractors

Diesel Tractor Fuel. Gasoline . . . Six Size

JOB

will do it better, at lower cost

Excavating a cellar or moving dirt for a Fort Peck Dam, no matter what the job, large or small, tough or easy, you'll do a better job at lower cost with Cletrac Crawler Tractors.

They're built that way . . . to take every job in their stride . . . with the traction, the balanced design, the power and stamina to get in and out of the tough spots . . . to keep costs on closely-bid jobs on a money-making basis.

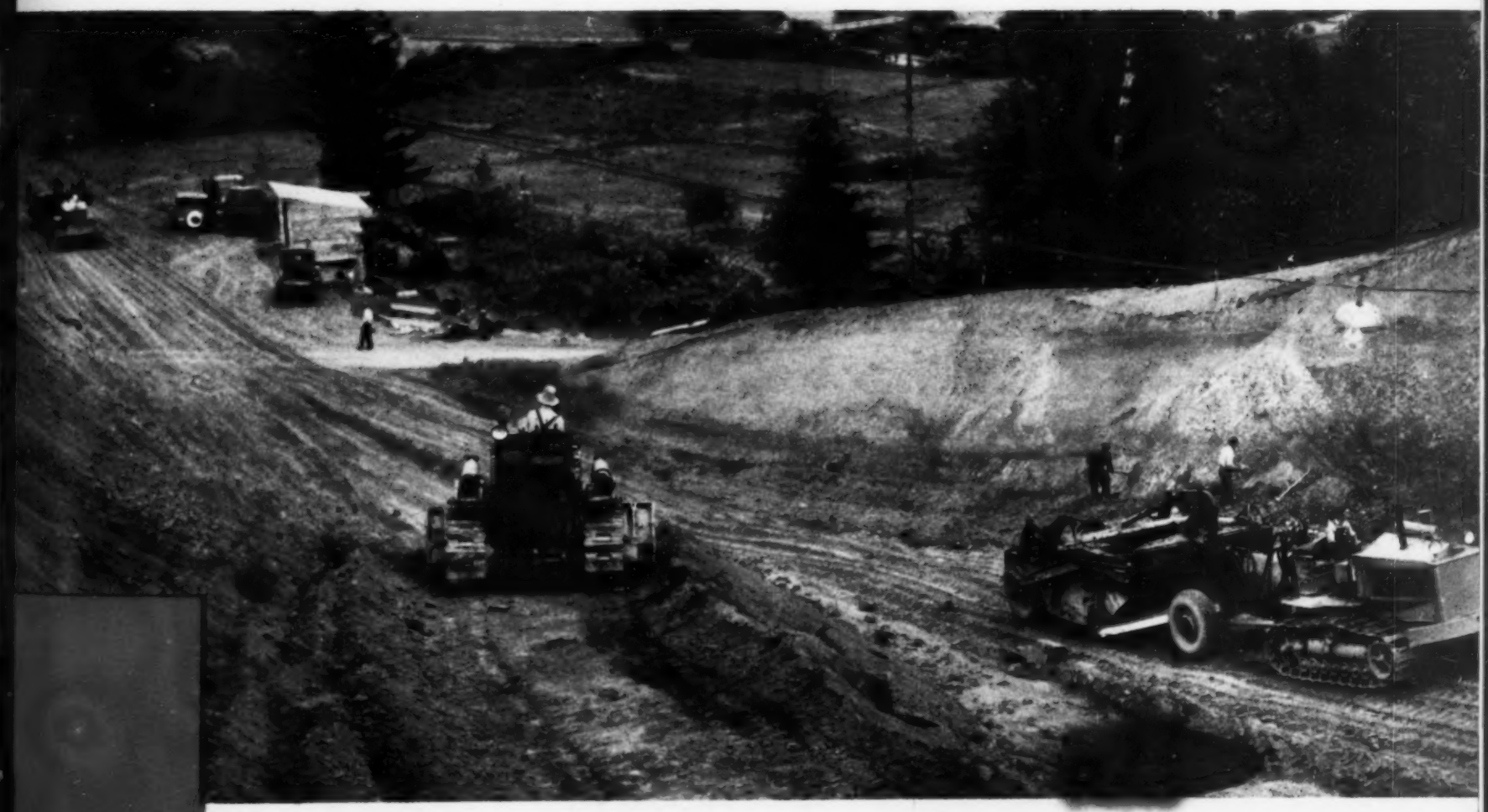
Check the Cletrac on the job . . . the size of the loads it pulls on the hills . . . its ease of handling in tight corners . . . its true-course steering — and safety — on the steepest grades . . . the economy of operation . . . the ease of maintenance.

Check Cletrac, too, for soundness of construction . . . the rigid main frame, the sturdy side frames, the dead axle, the controlled differential steering that keeps both tracks pulling at all times . . . the "Built to Endure" construction that makes Cletrac's economy possible.

There's a Cletrac for every power job . . . from 22 to 94 horsepower . . . Diesel, tractor fuel, or gasoline powered.

THE CLEVELAND TRACTOR CO.

CLEVELAND, OHIO



Cletrac
Crawler Tractors
Built To Endure

The only tractors with controlled differential steering that keeps both tracks pulling at all times . . . on the turn as well as on the straightaway.

ze . Fifteen Models . . . 22. to 94. Horsepower

LORAIN-77
LORAIN DIESEL
C. MOEBIUS
DUMP TRUCK SERVICE INC.
50 WECKER AVE.
BUFFALO, N.Y.
No 8
LORAIN-77
JAS. J. SHELLY CO.
THEW
CENTER
DRIVE
REG. U.S.
PAT. OFF.

THIS NEW BOOM *is making* SHOVEL HISTORY

THE strongest shovel boom per pound of weight ever designed—that's the new "front end" on the 1½-yd. Lorain-77. It is virtually two booms in one, with structural side members to absorb all bending and compression stresses; and a separate torsional member, consisting of a huge seamless tube, which absorbs all boom-twisting stresses. Each functions independently of the other to give exceptional known strength at minimum weight.

Greater strength and minimum weight are also obtained in the longer 18-ft. dipper stick through the use of steel tubing which offers the greatest combined bending and torsional resistance per lineal foot of weight.

Every feature of this new boom design is time-tested. A large number of Lorain-77's, equipped with this "front end," have already seen many months of actual service. Users were told to give them the works—treat 'em rough. Every report to date has verified the claims made for the strength of this boom.

The Lorain-77, by adding this new boom development to its already long list of exclusive features, further strengthens its position as the outstanding shovel in the 1½-yd. field.

LORAIN-77

THE THEW SHOVEL COMPANY
LORAIN, OHIO

FOR SHOVELS, TRUCKS, TRACTORS . . . EVERY PIECE OF EQUIPMENT YOU OPERATE . . . Gulf supplies the right lubricant for each requirement.

THERE are *three big advantages,* to contractors, in using Gulf quality lubricants:

First, the Gulf line includes more than 400 specialized oils and greases—lubricants *exactly suited* to the requirements of each piece of equipment on the job.

Second, there need be no guesswork about the proper lubricants to use; the Gulf engineer eliminates that! For he recommends, on the job, the right lubricant and best method of application for each requirement.

Third, when you order Gulf lubricants, you get them *promptly.* Gulf's wide distribution from Maine to Texas means prompt delivery to every contractor, no matter where his job is located in this territory.

Let an experienced Gulf engineer recommend the right oils and greases for your equipment. This careful attention to lubrication insures better performance and—almost invariably—lower costs for upkeep. A Gulf engineer is always at your service.

MAKERS OF THAT GOOD GULF GASOLINE AND GULFLUBE MOTOR OIL

GULF OIL CORPORATION • GULF REFINING COMPANY

GENERAL OFFICES: GULF BUILDING, PITTSBURGH, PA.

Another Bucyrus-Erie for GREAT LAKES DREDGE & DOCK COMPANY RIVER & HARBOR IMPROVEMENTS

making a total of

30

BUCYRUS ERIE

Bucyrus-Erie Co., South Milwaukee, Wis., U. S. A.

Two of Every Three Sales are Repeat Orders

HAULS MORE-SAVES MORE

GMC design is the result of cumulative experience—from decades back. For instance, GMC frames—the backbone of the load—are metallurgically strong without being uselessly heavy; GMC engines have a high ratio of pulling power of capacity rating; GMC axles, springs, wheels and brakes are preponderantly strong! And GMC drivers are protected by all steel cabs affording wide angle driving vision and unusual comfort features including healthful ventilation. Besides this, GMC's are smart looking. These features save upkeep cost, increase advertising value, pyramid profits—*especially with GMC prices so low!*

Time payments through our own Y. M. A. C. Plan at lowest available rates

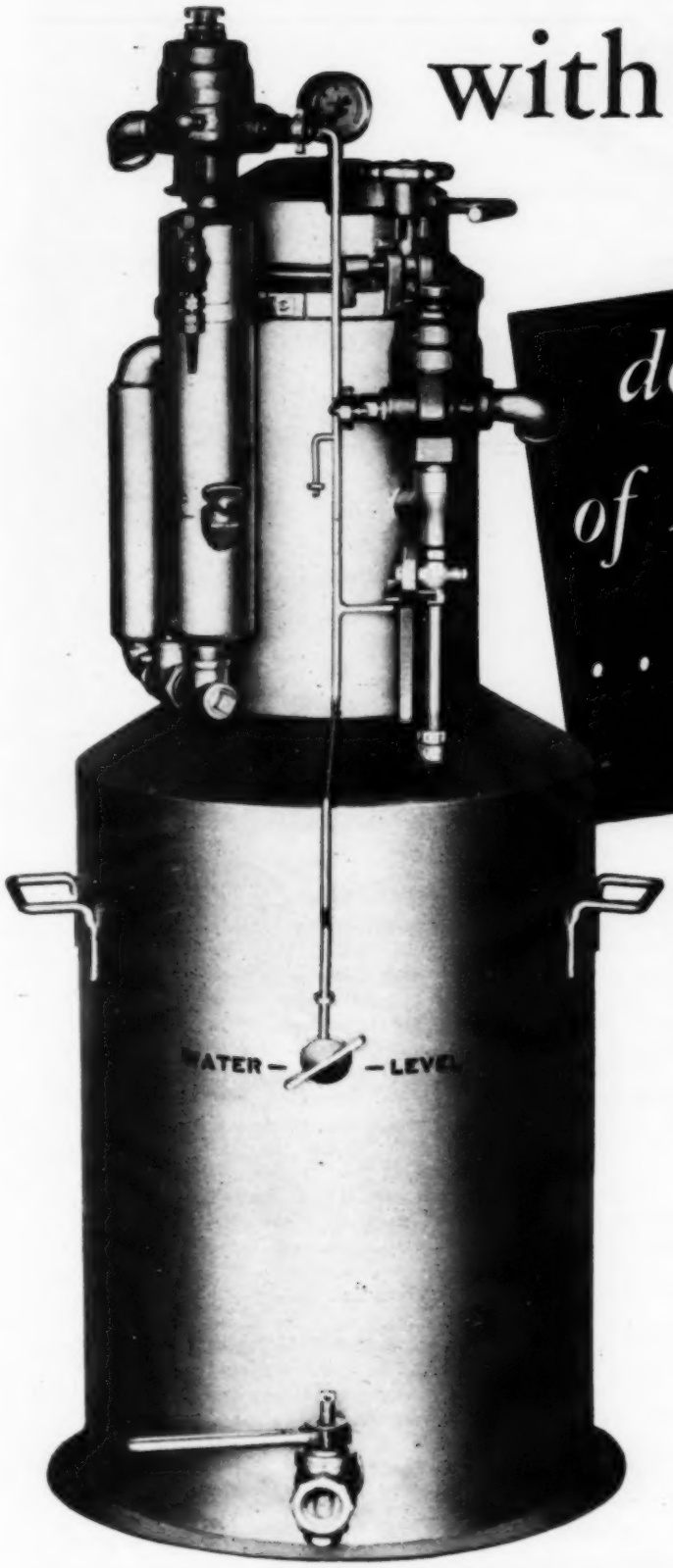
GENERAL MOTORS TRUCKS & TRAILERS

GENERAL MOTORS TRUCK & COACH • DIVISION OF YELLOW TRUCK & COACH MANUFACTURING COMPANY • PONTIAC, MICHIGAN

Generate *your own Acetylene*

with a Carbic CMP-1

Trade-Mark



delivers 45 cu. ft. of Acetylene an hour . . weighs only 120 lb.

*costs . . . $95.00**

The Carbic CMP-1 Medium-Pressure Portable Acetylene Generator has generating capacity enough for any operation normally requiring one large size acetylene cylinder. It generates acetylene from "Carbic" —high-grade calcium carbide processed and compressed into briquet form. It is economical, efficient, convenient and simple. Ask your Purox or Prest-O-Weld jobber to demonstrate the CMP-1 today.

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
New York and Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

SPECIFICATIONS: Height, overall . . . 52 in.; water shell, diameter . . . 17¼ in.; water capacity . . . 14¾ gal.; weight, empty . . . 120 lb.; weight, fully charged . . . 265 lb.; weight, shipping . . . 170 lb.; charge (No. 20 Carbic Cakes) . . . 1 to 8; acetylene generating capacity, per hr. . . . 45 cu. ft.

*** Prices slightly higher west of the Rocky Mountains.**

Everything for Oxy-Acetylene Welding and Cutting

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES FROM UCC LINDE UNION CARBIDE

Southwest Carry Scraper, revolutionary design, minimizes operating load on tractor and cables. 6, 8, 10 and 12-yard capacity.

Southwest Bottomless type Scraper takes accurate cuts from thinnest layer to 10" deep.

Southwest Heavy Duty Rippers have all the cost-cutting qualities a contractor demands—ruggedness, sure-action, easy-control. It's an efficient tool for the meanest kind of excavation—removal of rocks and roots; the tearing up of old gravel and macadam roads. At minimum cost they speed excavation by making the material suitable for any form of removal.

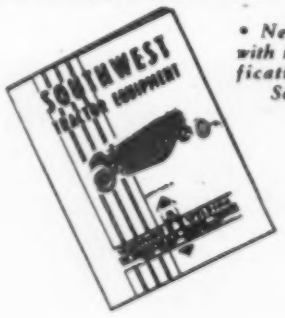
RUGGEDNESS of the main frame is assured through all welded steel box construction. Standards are nickel steel forgings, heat treated for more strength and wear. Points are hard faced with wear resisting material; are removable for low cost replacement.

SURE-ACTION is engineered into these units. Digging depths can be controlled, depending upon the type and resistance of the material to be removed.

EASY-CONTROL from the tractor seat is secured through either a cable control unit operated by a single drum winch or a hydraulic unit operated by an efficient hydraulic pump and valve mounted at the rear of the tractor.

Southwest also makes self-cleaning Rotary Rippers. There is a Ripper to suit the drawbar horsepower of your tractor.

SOUTHWEST WELDING & MFG. CO., Inc.
ALHAMBRA • CALIFORNIA



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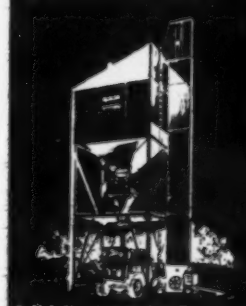
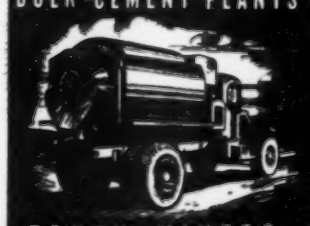


BULK CEMENT PLANTS



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The Self-Aligning feature alone makes this new Blaw-Knox **ROAD FORM** *a good buy for any Contractor*

- This new design of Road Form, which has been thoroughly proved in service, permits rapid form setting, always true to line and grade regardless of whether the steel stakes become bent or forced off plumb in stony ground.

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also: WEIGHING BATCHERS for Aggregates and Cement ... CENTRAL MIXING PLANTS ... TRUCK MIXER LOADING PLANTS ... STEEL FORMS for General Concrete Construction ... CONCRETE BUCKETS ... BOTTOMLESS SCRAPERS ... SHEEPSFOOT TAMPING ROLLERS

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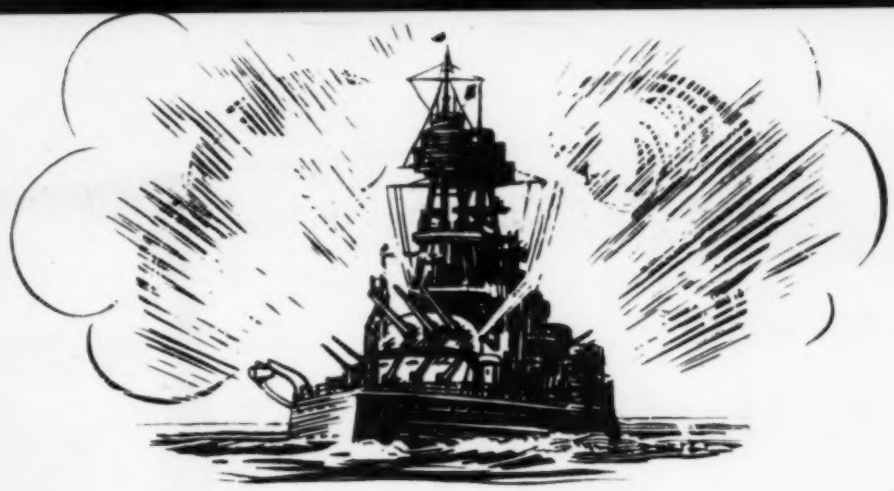

THE NATION PAYS TRIBUTE

TO A GREAT ENGINEERING ACHIEVEMENT

With the entire United States battle fleet riding in San Francisco's great harbor, the mighty Golden Gate Bridge was formally dedicated and opened to traffic on May 28, 1937. ● In erecting the cables for the Golden Gate Bridge in 6 months and 9 days, Roebling spun 80,000 miles of Roebling wire (as much as 1,000 miles per day, 33 tons per hour) . . . and created an all-time speed record! ● Other Roebling Products used on the bridge or in connection with its erection, include, in part, over 38 miles of $2^{11}/_{16}$" diameter wire rope suspenders, 808 tons of erection ropes, 1,250,000 feet (237 miles) of electric light, power, and signal wire, and 90,000 square feet of woven-steel wire fabric. ● John A. Roebling's Sons Co., Trenton, New Jersey. ● Branches in Principal Cities.

CABLES SPUN BY

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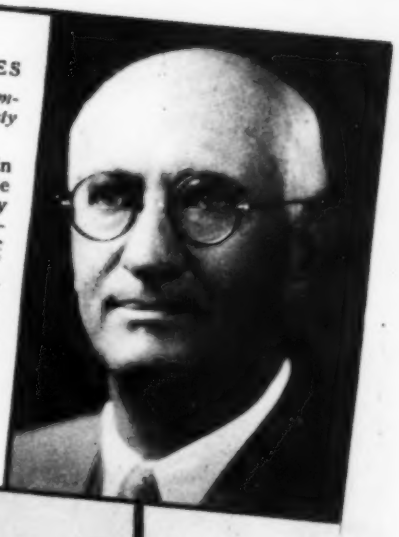
FROM HIS SIMPLE IDEA CAME TODAY'S *Permanent Safety Marker*



EDWARD N. HINES

Board of County Road Commissioners, Wayne County (Detroit), Michigan

"To Edward N. Hines, in recognition of his notable contribution to highway safety through the introduction of the center traffic line now in universal use" —reads the plaque presented by the B. F. Goodrich Company in 1936. The plaque was presented to Mr. Hines only after the Goodrich Company had searched the entire country to determine the originator of the center traffic line idea.

Traffic markers and curbing of Atlas White Portland Cement in Michigan Superhighway, near Dearborn. Installed by Board of County Road Commissioners, Wayne County. J. K. Norton, Road Engineer.

EVEN as far back as 1912, traffic had its problems. It was in that year that Edward N. Hines of the Wayne County Road Commissioners, (Detroit), Michigan—aiming at the "road hog"—hit on the idea of running a white stripe down the center of roads and streets.

A simple idea—yet one of the most important contributions to traffic safety ever made. From it came the permanent safety marker of portland cement. Today traffic markers made of Atlas White Portland Cement form safety lanes for many thousands of miles of country and city traffic.

Atlas White markers are strips of hard, durable concrete built right into the pavement. White all the way through, they always stay white. The worst weather can't dim them. They stay white, and they stay put!

Once installed, in old or new pavements, Atlas White markers are in for good—their first cost is your last cost. Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South La Salle Street, Chicago.

Help Build Safety Into Streets and Highways with Atlas White Traffic Markers Made with Atlas White Portland Cement—Plain and Waterproofed

M-11

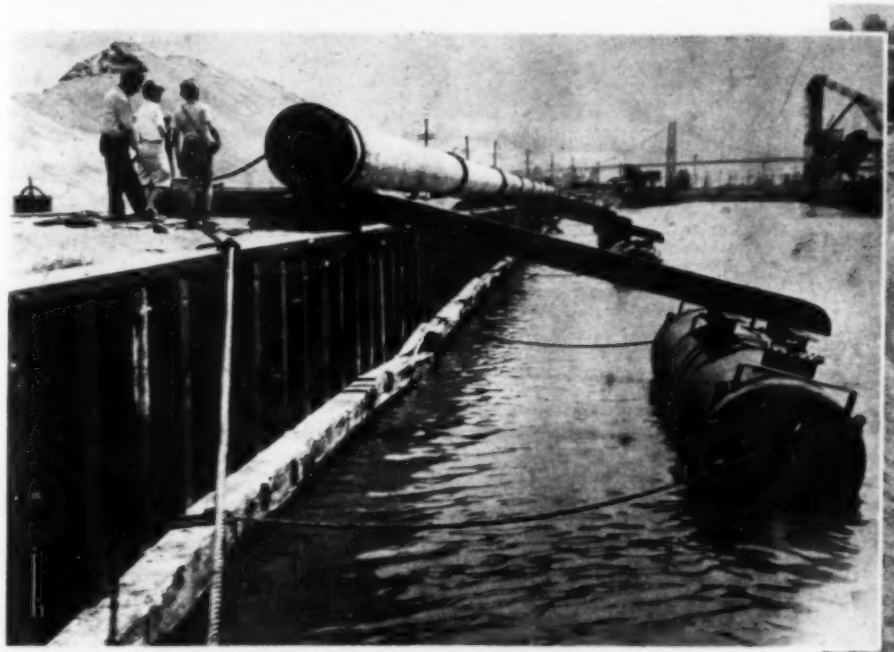
ATLAS WHITE PORTLAND CEMENT
FOR TRAFFIC MARKERS

Construction Methods and Equipment

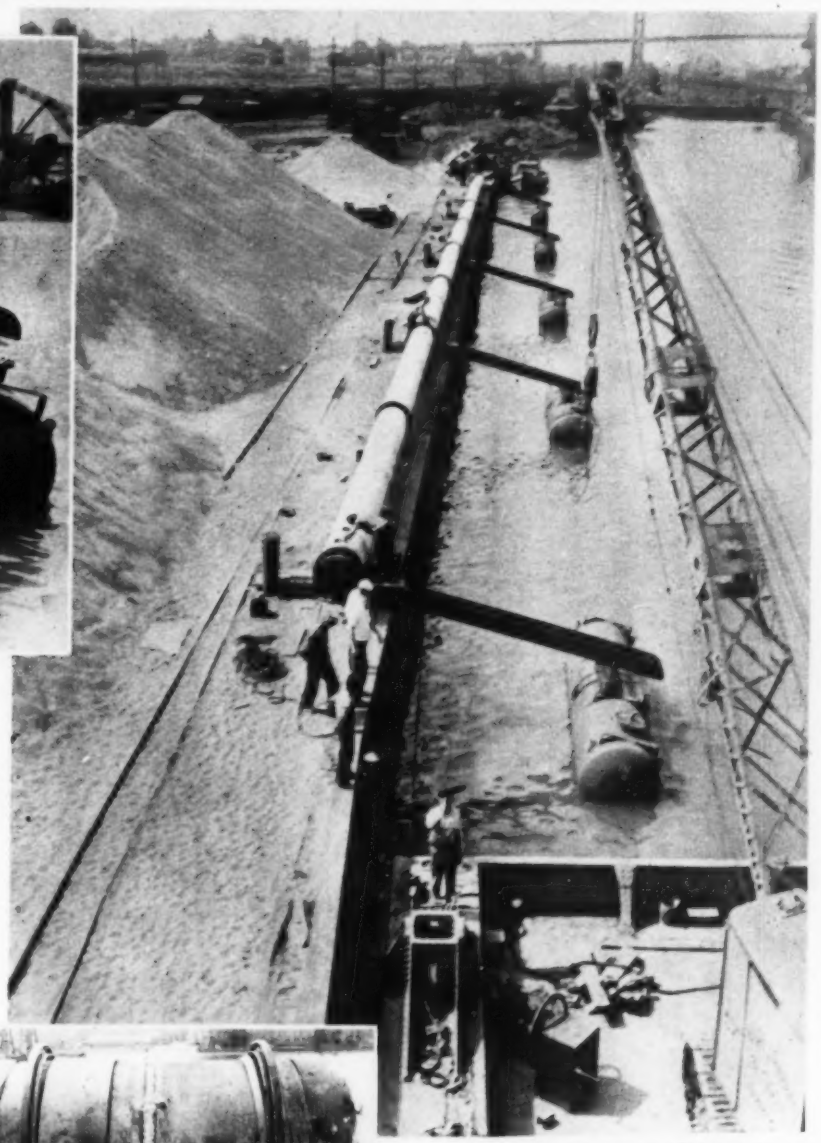
Established 1919 MnGraw-Hill Publishing Company, Inc.

ROBERT K. TOMLIN, Editor

Volume 19 **July, 1937** Number 7



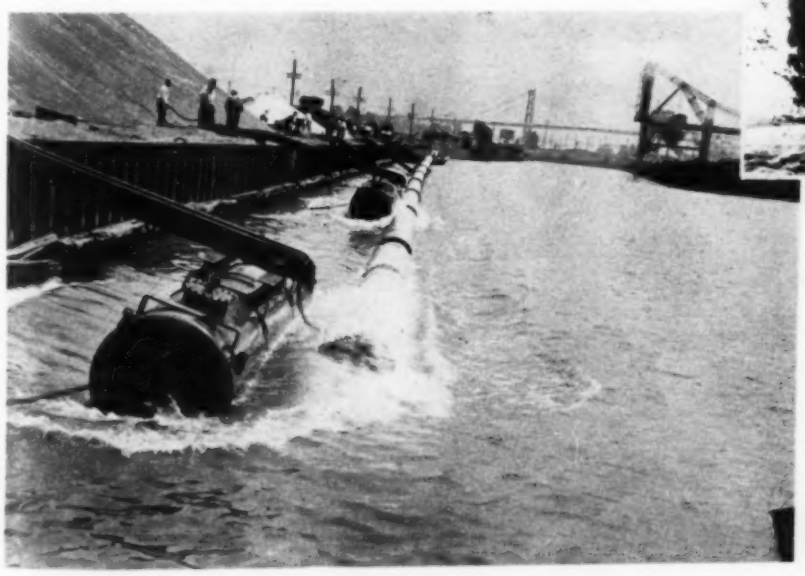
READY FOR PLUNGE. Pipe line, with bulkheads in ends, is in position to roll into water along inclined ways supported by cylindrical steel pontoons.



ASSEMBLY OF PIPE LENGTHS into section 320 ft. long on top of bulkhead wall is done by welding.

Pipe Launched on Inclined Ways

WELDED JOINTS *(above)* between pipe sections are reinforced by Dresser couplings over each weld in line.



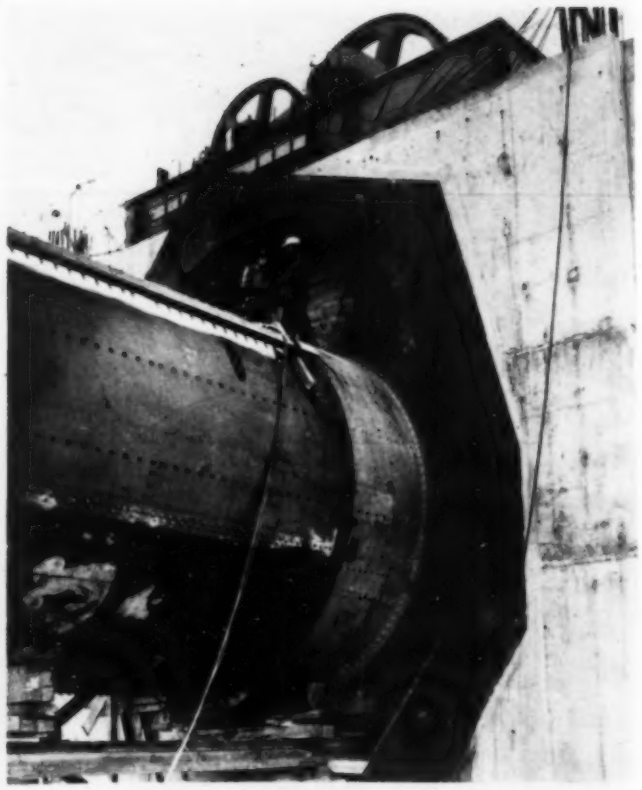
PERFECT ALIGNMENT *(left)* of 320-ft.-long section is maintained as pipe hits water and floats, preparatory to being towed to place and sunk to river bottom.

AS PART of a 30-in. submarine steel pipe line crossing the Maumee River at Toledo, Ohio, a section of pipe 320 ft. long was welded on shore, along the top of a bulkhead wall, and launched by rolling down inclined ways supported at their lower ends by cylindrical steel pontoons, as illustrated in the accompanying photographs. Each pipe joint was protected by installing a Dresser coupling over each weld. The work was done for the Toledo Water Department, of which P. W. Egbert is superintendent, by M. Rabbit & Sons, local contractor, under a $79,000 contract.

This Month's "NEWS REEL"

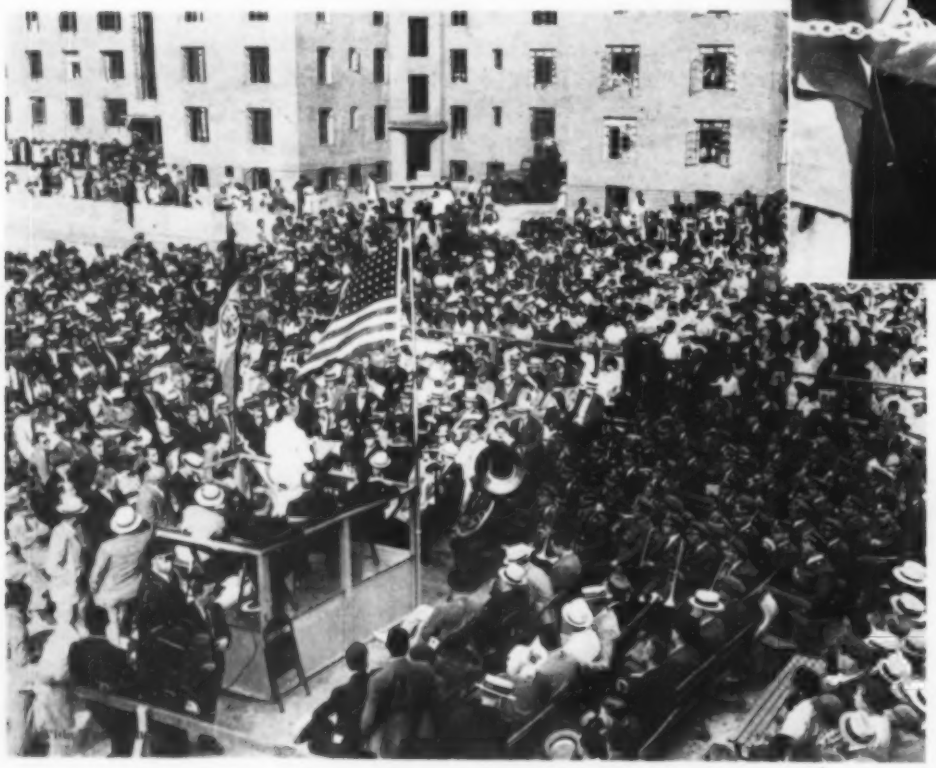
FIRST TRAFFIC

(above) crosses San Francisco Bay over Golden Gate bridge, with world's longest cable suspension span of 4,200 ft., after chain barrier is severed May 28 by Mayor Angelo Rossi *(right)*, of San Francisco, with oxyacetylene torch. During first week of service 175,625 motor vehicles passed toll gates of new structure.



TO CONTROL FLOW

of Colorado River into headworks of All-American canal, in California, four cylindrical gates 23 ft. in diameter and 75 ft. long, of type illustrated above, are being installed at Imperial dam, being built near Yuma, Ariz., under direction of U. S. Bureau of Reclamation. Canal will carry 15,000 sec.-ft. of water for irrigating deserts of Southern California in Imperial and Coachella valleys.



HARLEM RIVER HOUSES,

PWA low-rent negro dwelling project on 9-acre site in New York City, is dedicated June 16. Group of houses, costing $4,219,000, contains 1,940 rooms and provides 574 living units. Contractors: Cauldwell-Wingate Co. (superstructures) and Carleton Co., Inc. (foundations).

2,500,000TH CUBIC YARD

of concrete is placed in Grand Coulee dam *(right)* on Columbia River in Washington June 16. Crew of Mason-Walsh - Atkinson - Kier Co. trips 4-yd. bottom-dump bucket on U. S. Bureau of Reclamation project on which work is now one year ahead of schedule.

OPEN CONCRETE CAISSONS

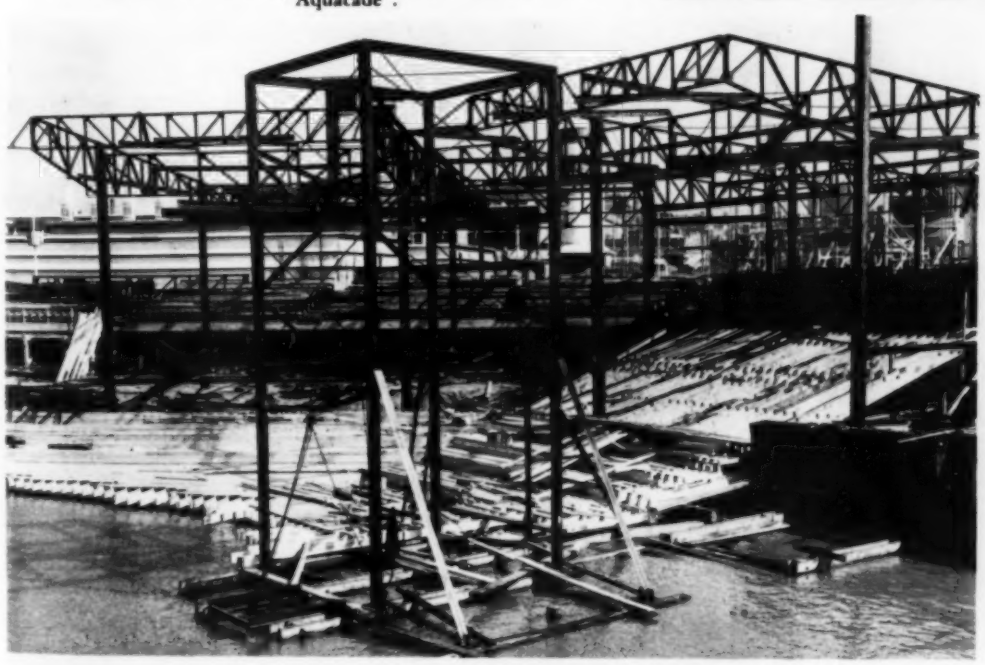
of two types are sunk through clay by H. J. Deutschbein Co., Inc., New York contractor, at power station addition for Cincinnati Gas & Electric Co., at Columbia Park, Ohio. In background is 82-ft.-diameter condenser well caisson extending to depth of 70 ft. In foreground are oblong rounded-end caissons, 10 ft. wide and from 24 to 31 ft. long, varying in depth from 40 to 55 ft. The smaller caissons, described elsewhere in this issue, will support pairs of columns for power station superstructure. Lundy & Sargent, Inc., of Chicago, served as consulting engineers on project. L. F. Booth is field engineer for the contractor.

ARCHITECTURAL CONTRACTS

for three New York World's Fair buildings, to house exhibits on Transportation, Shelter and Production, are signed by President Grover Whalen (center). Seated, left to right, are John C. B. Moore, James Gamble Rogers, Grover Whalen and Joseph Freedlander. Standing, left to right: W. Earle Andrews, general manager of the Fair, Stamo Papadaki, R. W. McLaughlin, Jr., Charles W. Beeston, Irvin L. Scott, architect of Fair, Maximilian Bradford Bohm and Col. John P. Hogan, chief engineer of Fair.

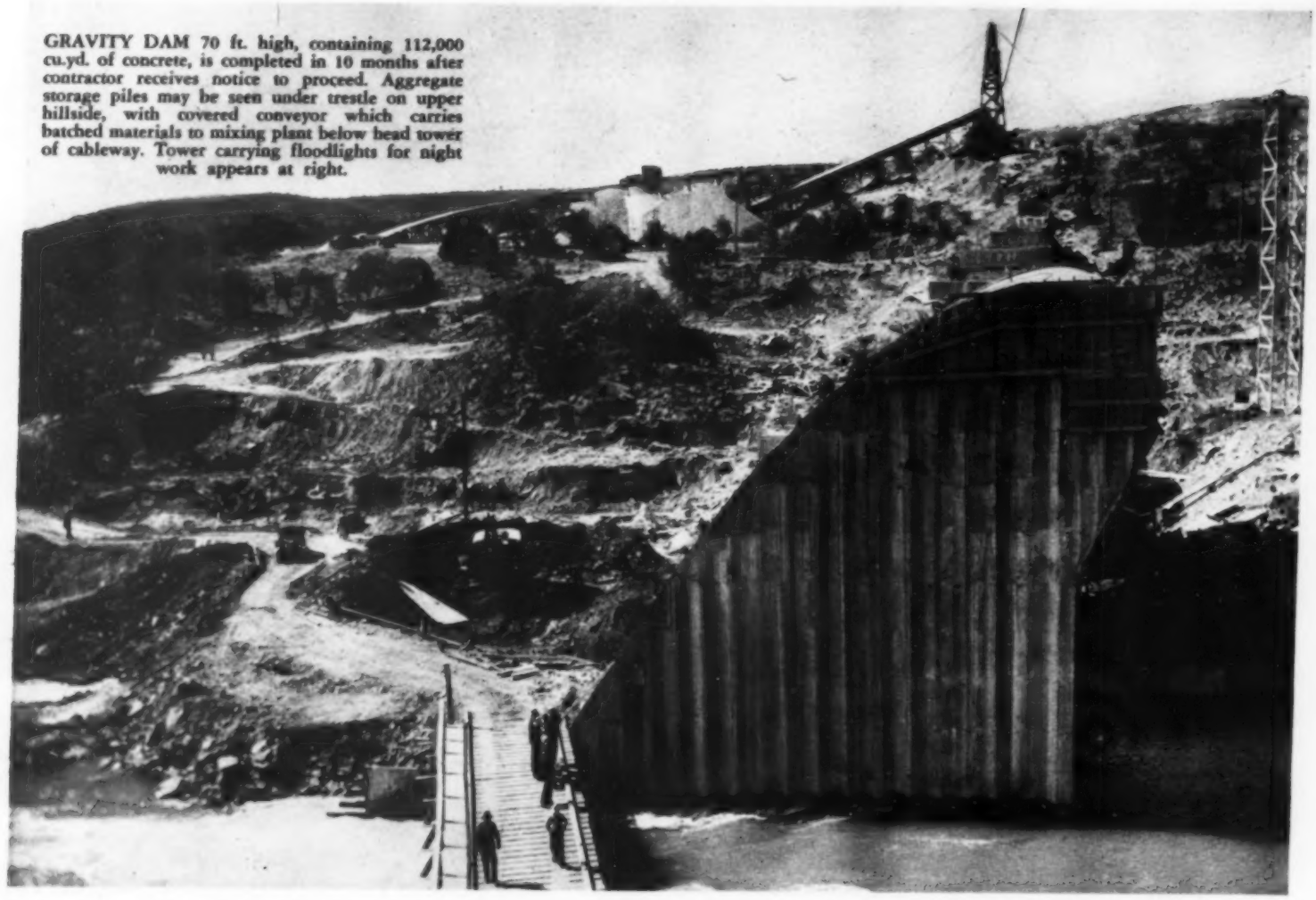
MARINE THEATRE

(below) and restaurant to seat 5,000 at Cleveland's Great Lakes Exposition is rushed to completion on pile foundations covering waterfront area of 120,000 sq.ft. Project includes 128-ft. floating stage where swimming champions Eleanor Holm Jarrett and Johnny Weissmuller, will perform in producer Billy Rose's "Aquacade".



CONCHAS DAM,

U. S. Engineer Department project on South Canadian River in New Mexico, reaches early stages of concreting foundations by Bent Bros., Inc. and Griffith Co., both of Los Angeles. Concrete structure 220 ft. high and 1,160 ft. long, flanked by earth dikes, is being built under direction of Capt. Hans Kramer, *(inset, at right)* Corps of Engineers, U. S. Army, who is introducing Governor Tingley at ceremonies signalizing placing of first concrete.



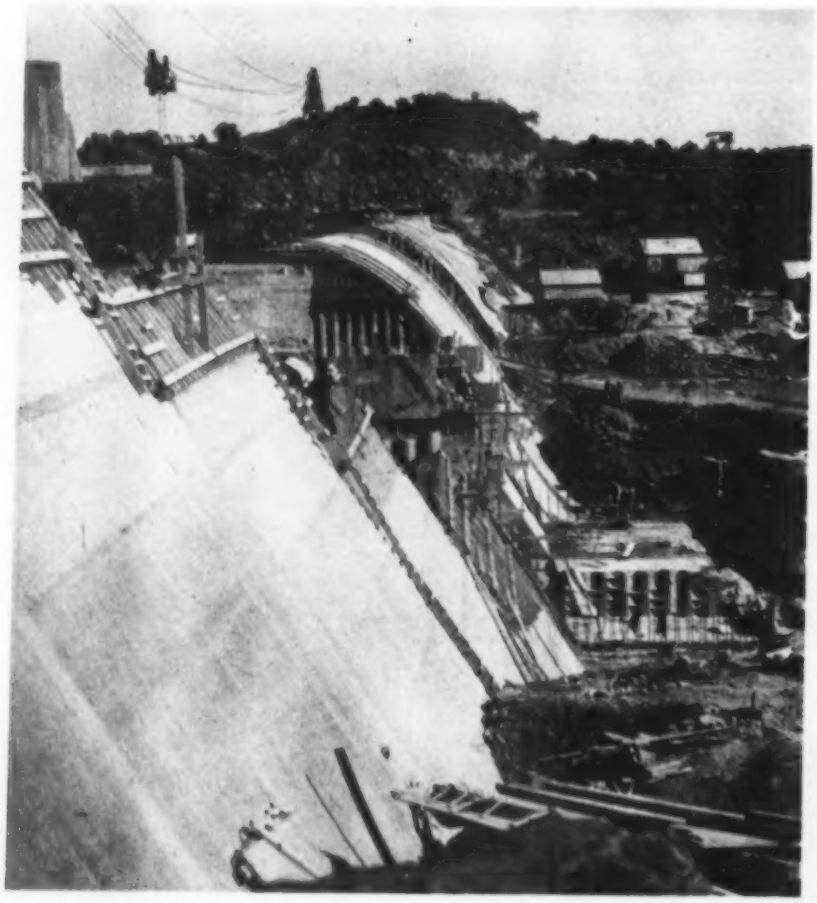
GRAVITY DAM 70 ft. high, containing 112,000 cu.yd. of concrete, is completed in 10 months after contractor receives notice to proceed. Aggregate storage piles may be seen under trestle on upper hillside, with covered conveyor which carries batched materials to mixing plant below head tower of cableway. Tower carrying floodlights for night work appears at right.

SMALL CONCRETE CREW

Puts Out

BIG YARDAGE

on Texas Dam



TRAVELING TAIL TOWER of cableway (above east abutment on far side of valley) gives complete coverage of dam with runway 350 ft. long.

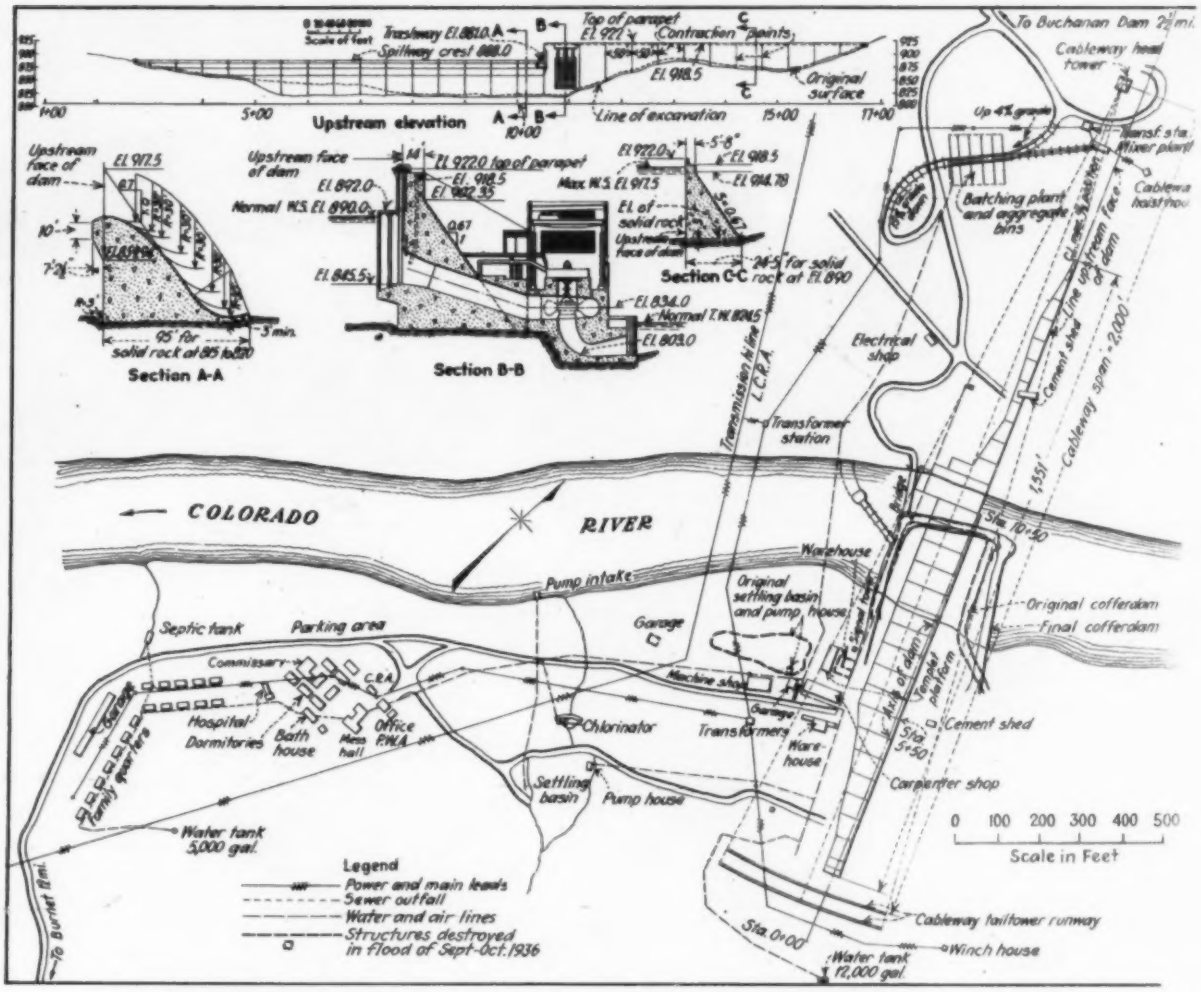
A SMOOTH-RUNNING construction organization headed by B. (Woody) Williams, formerly assistant superintendent at Boulder dam, made rapid progress in building the Roy B. Inks concrete gravity dam 70 ft. high for the Morrison-Knudsen Co., Inc., Boise, Idaho, under contract with the Lower Colorado River Authority, a Texas body charged with carrying out a flood-control and water conservation program on this river with the aid of a $20,000,000 loan and grant from PWA. Following three unprecedented floods during September-October, 1936, which drowned out the site and caused considerable damage, the Morrison-Knudsen field force quickly put the project on a going basis and from that time on showed a good record of work accomplished for each estimate period. The contractor received the work order for the job July 27, 1936. In spite of the setback caused by floods running in contradiction of all past evidence in the river hydrograph, the construction organization removed 35,000 cu.yd. of rock and placed 112,000 cu.yd. of concrete in time to complete the entire contract ready for acceptance by May 27 of this year, 10 months after receiving notice to proceed.

Efficient layout and skilled personnel employed in the batching, mixing, delivery and placement of concrete made it possible to carry out the entire series of operations from batching materials to cleaning a completed lift with a remarkably small crew of ten men. A 2,000-ft. cableway delivered concrete from the mixing plant (equipped with two 2-yd. tilting mixers) to all points along the 1,550-ft. length of dam. Concrete crews worked 5 hr. 40 min. per day for 7 days each week to make

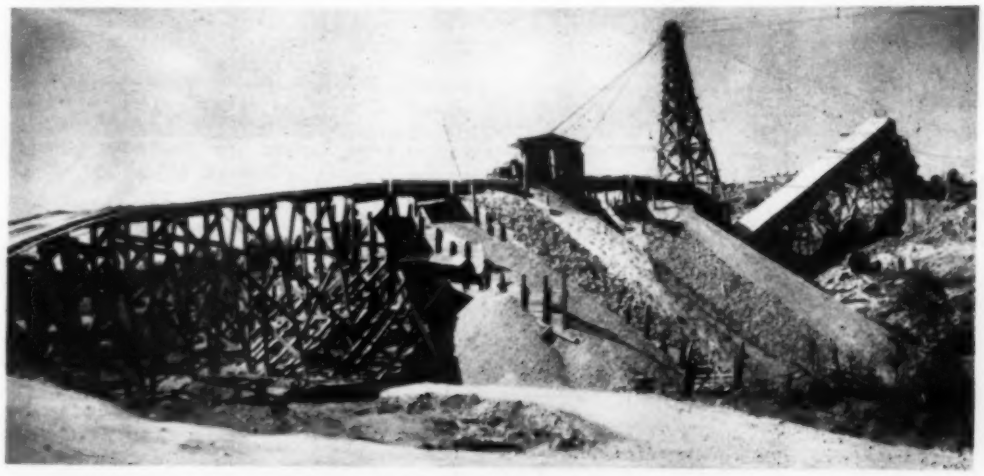
their allotted 40 hr. per week. Mixing 1½-yd. batches in the 2-yd. drums and delivering 3 yd. of concrete per trip at an average one-way travel distance of 800 ft., a single shift of ten men placed as much as 500 cu.yd. in 5 hr. 40 min. This record was attained or closely approached several times but it, nevertheless, was somewhat out of the ordinary, as can be appreciated from the fact that each member of a concrete crew received a bonus each time his shift exceeded 300 cu.yd. It was not unusual for a shift to make four bonuses in one week.

Construction Layout — As shown on an accompanying map, the batching and mixing plant and the fixed head tower of the cableway were set high on the hillside at the west end of the dam, where trucks hauling these materials could deliver them without having to cross the river. Aggregates and cement were supplied to the contractor 2½ mi. upstream at Buchanan dam, another project of the Lower Colorado River Authority. The trucks dumped from a trestle into live storage piles feeding through weighing hoppers to a 42-in. belt which raised the dry batches to the mixing plant.

Shops, camp buildings and water supply storage were placed on the east side of the river. River water was pumped to a hillside settling basin which supplied both mixing plant and camp. Mixing water was pumped from the basin to a 12,000-gal. tank at a higher level on the same hillside. From



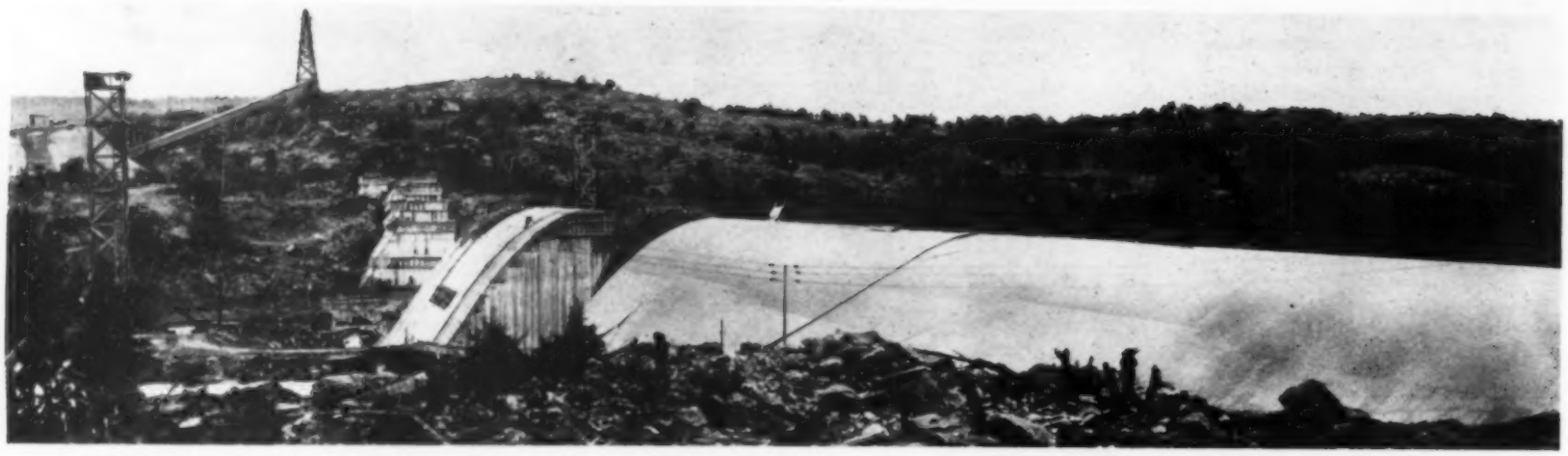
CONSTRUCTION LAYOUT at Roy B. Inks dam on Colorado River of Texas. Power house shown in section B-B is not being constructed under present contract but will be built later by Lower Colorado River Authority.



TRESTLE for motor trucks permits dumping directly into live aggregate piles and bulk cement bin above batching tunnel. Inclined conveyor, completely inclosed, carries batched materials out of tunnel to mixing plant.

WELL PLANNED ARRANGEMENT of mixing plant and cableway hoist house enables hoist operator to spot bucket under mixers without services of signalman.

IN FULL VIEW of hoist operator in cableway hoist house, bucket is lowered into position under discharge funnel of twin tilting mixers.



CABLEWAY of 2,000-ft. span delivers concrete to all parts of dam 1,550 ft. long. Dam is constructed in 50-ft. blocks.

this tank it was delivered by a long pipe line to the mixing plant on the other side of the valley. Camp water filtered out of the settling basin through a sand embankment to a small collecting pool where a chlorinator treated the water as it entered a pipe line leading to a 5,000-gal. tank above the camp. Pumps and practically all other power equipment on the job except excavators were driven by electric motors. Power from a 12,500-volt transmission line at the site was stepped down by two transformer banks to 440/220 volts.

Cableway — Spanning a horizontal distance of 2,000 ft. between head blocks, the cableway had a 110-ft. head tower rising to El. 1090 and an 86-ft. traveling tail tower with its crown block at El. 1009. Fully loaded with 4 yd. of concrete at the center of the span, the 2½-in. flattened-strand track rope sagged 120 ft. below a straight line between the head blocks. Loaded in this way the minimum elevation of the track cable was 952, while the parapet above the penstock section of the dam was El. 922, leaving 30-ft. clearance for carriage hoisting falls and bucket. Actually only 3-yd. loads were handled. A travel arc of 350 ft. for the mobile tail tower, operated by remote control from the cableway hoist house, gave complete coverage of the dam. The hoist house was located to give the cableway operator a view of the entire job and of the mixing plant, where he could spot his bucket without the aid of a signal man.

A two-drum-and-gypsy hoist engine from the Boulder dam job, driven by a 300-hp. electric motor, operated the cableway at 1,200 ft. per minute. A loaded bucket coasting down the inclined track rope from the mixing plant increased this speed to 1,500 ft. per minute. Only one main drum and the gypsy were used for hauling and hoisting. A single-drum hoist engine driven by a 40-hp. motor moved the tail tower on a continuous hauling rope. The cableway carriage was a special unit built at Bonneville dam by Dave Williams, superintendent of cableway on that contract for the Columbia Construction Co. (Morrison, Knudsen, Bechtel, Kaiser, Utah, McDonald & Kahn).

Foundations — Texas red granite and gneiss forms the foundation of the dam. Although badly broken in places the rock was comparatively free from cracks and fissures and took less than 2 cu.ft. of grout for each linear foot of grout hole drilled. After stripping 20,000 cu.yd. of earth and gravel overburden the contractor had to remove 35,000 cu.yd. of rock to prepare the foundation for the dam.

Two large stationary compressors, two-stage, 709-in. displacement, 225 r.p.m., each belt-driven by a 152-hp. electric motor, supplied air for the drilling. This work was done by two wet sinker drills, two hammer drills, one wagon drill, eight hand-held drills and a paving breaker.

Earth and broken rock were loaded by two 1½-yd. shovels with 92-hp. gasoline engines into trucks for disposal. One excavator operated part of the time as a dragline.

Working Program — Excavation started at the east side of the river, muck being placed in an earth and rock cofferdam inclosing this end of the dam as far out as block 16, as indicated on the construction layout. The cofferdam was built to take care of the peak autumn flood of record, 77,100 sec.-ft. in 1918; but the three successive runoffs of September-October, 1936, tripled this volume, discharging 212,000 sec.ft. Ordinary flow in the Colorado River is less than 1,000 sec.-ft.; but quick runoff in the watershed produces flash floods that cause great damage.

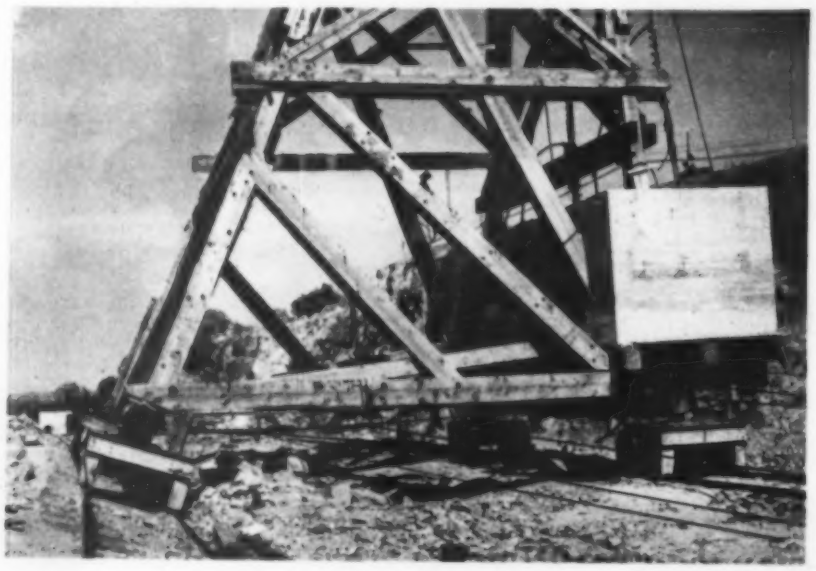
Resuming operations after the floods had passed, the contractor built the blocks in the east section of the dam, leaving low sills in 11, 12 and 13 to carry the river flow when construction would be transferred to the west side of the channel. On Feb. 8 the cofferdam was opened and the river diverted through these blocks. The river was passed through this gap until April 1, when it was diverted through a 15-ft. gap in block 17. Status of construction at the latter date is indicated by an accompanying progress drawing.

Batching Plant — Rented trucks hauled aggregates and cement to the batching plant. An elevated tipple above the live storage bins enabled the trucks to discharge their loads directly into the proper compartments. Special hopper-body trucks equipped with radial gates transported bulk cement in 150-sack lots.

Concrete in the dam contained four sizes of coarse aggregate in addition to sand and cement. The aggregate sizes were 3/16 to ¾ in.; ¾ to 1½ in.; 1½ to 3 in.; and 3 to 6 in. Based on clean separation of aggregate in the laboratory, the theoretical mix amounted to 1:2.8:5.7, with a cement factor of 1.12 bbl. per cubic yard. Actual field mixes, because of imperfect aggregate separation, were adjusted to about

Major Contract Quantities and Prices
Roy B. Inks Dam

Item	Quantity	Unit Price	Amount
River diversion and unwatering foundations			25,000.00
Excavation, common	19,650 cu.yd.	.50	9,825.00
Excavation, rock	25,000 cu.yd.	3.00	75,000.00
Grout holes up to 25 ft. deep	3,900 lin.ft.	.50	1,950.00
Grout holes, 25-50 ft.	6,700 lin.ft.	1.75	11,725.00
Grout holes, 50-100 ft.	600 lin.ft.	2.80	1,680.00
Pressure grouting	12,000 cu.ft.	1.00	12,000.00
Drainage holes up to 25 ft. deep	150 lin.ft.	2.70	405.00
Drainage holes, 25-50 ft.	3,900 lin.ft.	2.70	10,530.00
Concrete in dam	131,000 cu.yd.	3.60	471,600.00
Concrete in spillway bucket	3,000 cu.yd.	4.00	12,000.00
Concrete in training wall	550 cu.yd.	6.30	3,465.00
Concrete in parapet	75 cu.yd.	20.00	1,500.00
Concrete in trash-rack structure	550 cu.yd.	14.20	7,810.00
Placing rein. bars	492,000 lb.	.019	9,348.00
Install. power penstock	66,000 lb.	.018	1,188.00
Install. penstock headgates and guides	50,000 lb.	.025	1,250.00
Install. trash-rack metal work	48,000 lb.	.013	624.00
Install. metal guides in stop-log grooves	6,000 lb.	.07	420.00
Install. standard metal pipe, fittings and valves	135,000 lb.	.045	6,075.00
Total contract price	$668,328.50		



MOUNTED ON TRUCKS of double-flanged wheels, counterweighted timber tail tower is operated by remote control from cableway hoist house on other side of valley. Shed at far end of runway houses electric hoist engine which moves tail tower on continuous rope.

1:2.5:5.9, with the same cement content. Slump was limited to a maximum of 2½ in. All concrete was vibrated internally with high-frequency rigid-shaft pneumatic vibrators.

In a timbered tunnel under the bins was a battery of six automatic weighing batchers arranged for one-man control of the measuring of the six dry ingredients of the mix. Aggregate batchers and sand batcher were equipped with air-controlled radial cutoff gates operated by air rams, while the cement batcher had a vane feeder driven by a 3-hp. electric motor. The six batchers discharged in sequence upon a 42-in. belt which carried the materials from the tunnel upgrade to the charging hoppers at the mixing plant. Coarse aggregates discharged first upon the belt, followed by sand and cement, to prevent backward rolling on the steep grade. The conveyor was housed for its entire length to avoid blowing of the cement on top of the batch.

Because the coarse aggregate was crushed rock with little tendency to roll, it was possible to increase the belt angle above the manufacturer's recommended maximum of 18 deg. to an angle of 20 deg. 18 min., thus gaining additional space for live storage of materials. The conveyor measured 340 ft. between centers of 54x44-in. pulleys. It was equipped with ten-ply 42-in. rubber belting riding on 90 troughing idlers and 30 return idlers, all turning on roller bearings. The conveyor was driven by a 200-hp. electric motor, 2,200 v., 875 r.p.m., direct-connected to a 7.53:1 speed reducer.

Mixing Plant — Specifications required a 2-min. mixing period for 2-yd. mixers, and when the concrete crews were working at maximum speed the cableway took batches away as quickly as the mixing was completed. Two 2-yd. tilting mixers turned by multiple-V-belt drive from 50-hp. motors, 900 r.p.m., and tilted by air rams with cushioned ends produced the concrete for the dam.

Concrete Production — Because of the floods last fall, no concrete was placed in the dam until Nov. 4. The last of the 112,000 cu.yd. in the dam was placed just 7 months later. A good week's production is indicated by the accompanying progress chart, which shows 6,718 cu.yd. for the 7 days from March 21 to March 27 inclusive. When a shift handled as many as 187 buckets in 480 min. the cableway made a round trip every 2½ min.

This volume of concrete was produced and placed during the short shifts by crews comprising only ten men, in the following classifications: one batcher man, one mixer man, one cableway operator, one signal operator, one foreman in charge of placing concrete and five concrete laborers. The ten- man organization took care of all duties up to and including clean-up.

Variable radii on the dam surface prevented repeated use of standard form panels. The blocks in the dam were each 50 ft. wide, and wooden form panels were used in various sizes from 5x50 to 16x50 ft.

Construction Force — At the peak the contractor employed 447 men per 24-hr. day, some working in 8-hr. shifts and others in 5-hr. 40-min. shifts. Drill operators, for example, were able to work 8-hr. shifts 5 days a week, while the concrete crew and truck drivers hauling concrete materials had to work 5 hr. 40 min. each day throughout the week. On the week ending March 27 the job employed 317 men, which was a fair average for the entire construction period.

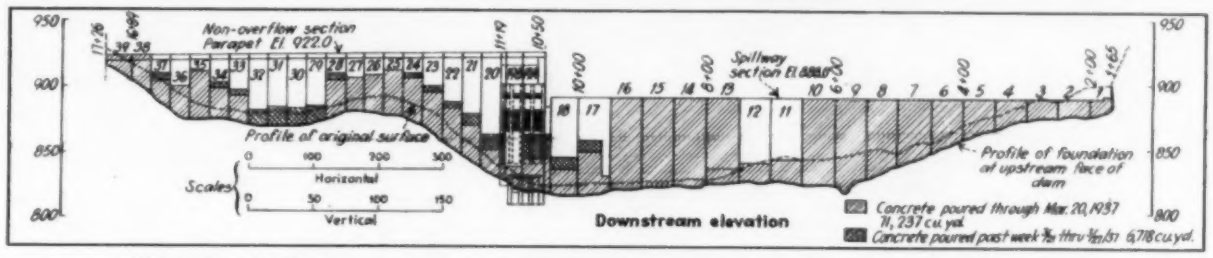
Camp accommodations were provided for 100 men and seventeen families. Much of the labor was drawn from Burnet, only 12 mi. distant, and most of the men preferred to live in town.

Administration—Roy B. Inks dam was constructed for the Lower Colorado River Authority by the Morrison-Knudsen Co., Inc., Boise, Idaho.

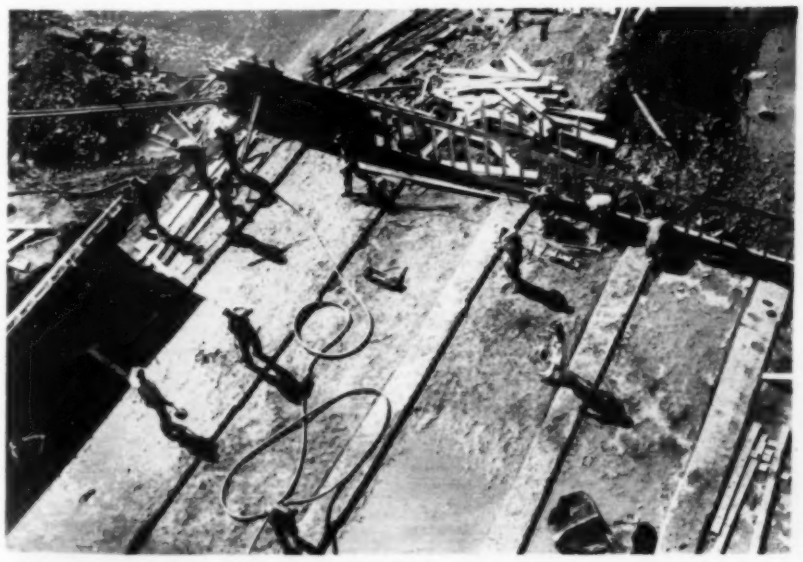
Clarence McDonough as general manager, R. B. Alsop as superintendent of construction and Holton Cook as resident engineer have charge of construction for the Authority.

B. Williams is superintendent of construction, and A. J. Ranney is resident engineer, for the contractor.

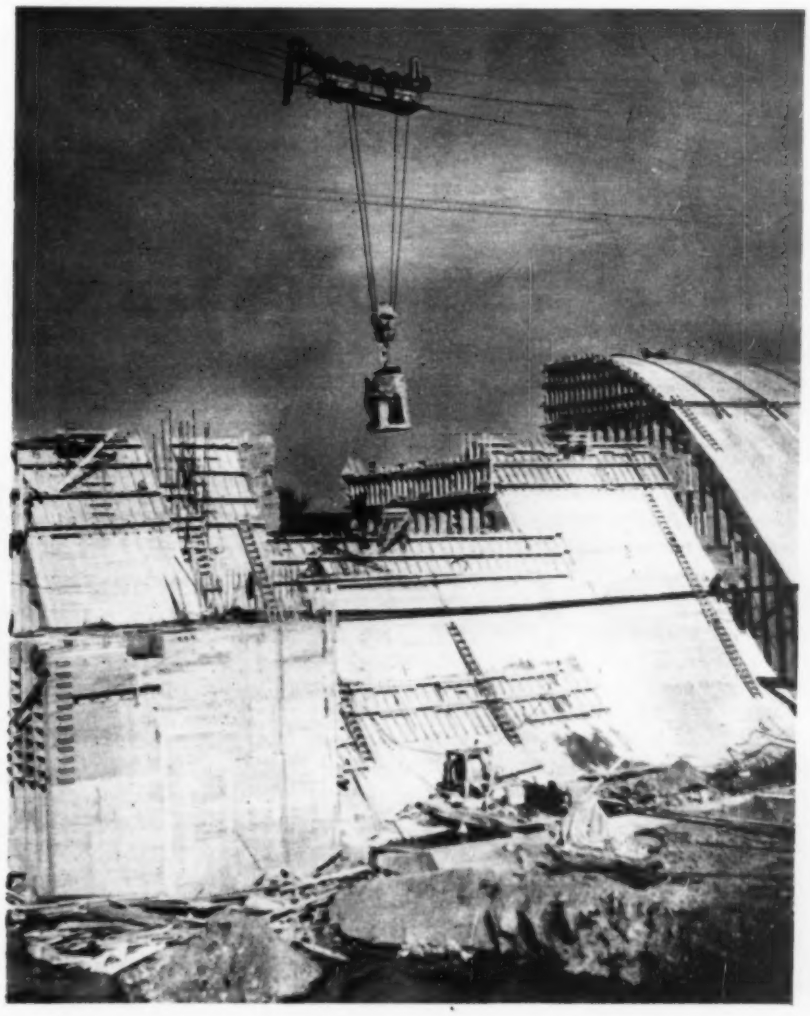
BULK-CEMENT TRAILER of 150-sack capacity is one of special units built by contractor for hauling this material 2½ mi. to storage bin under trestle.



PROGRESS CHART for one week shows 6,718 cu.yd. of concrete placed in 7 days. Slot left in block 17 passes river flow after blocks 11 and 12 are closed.

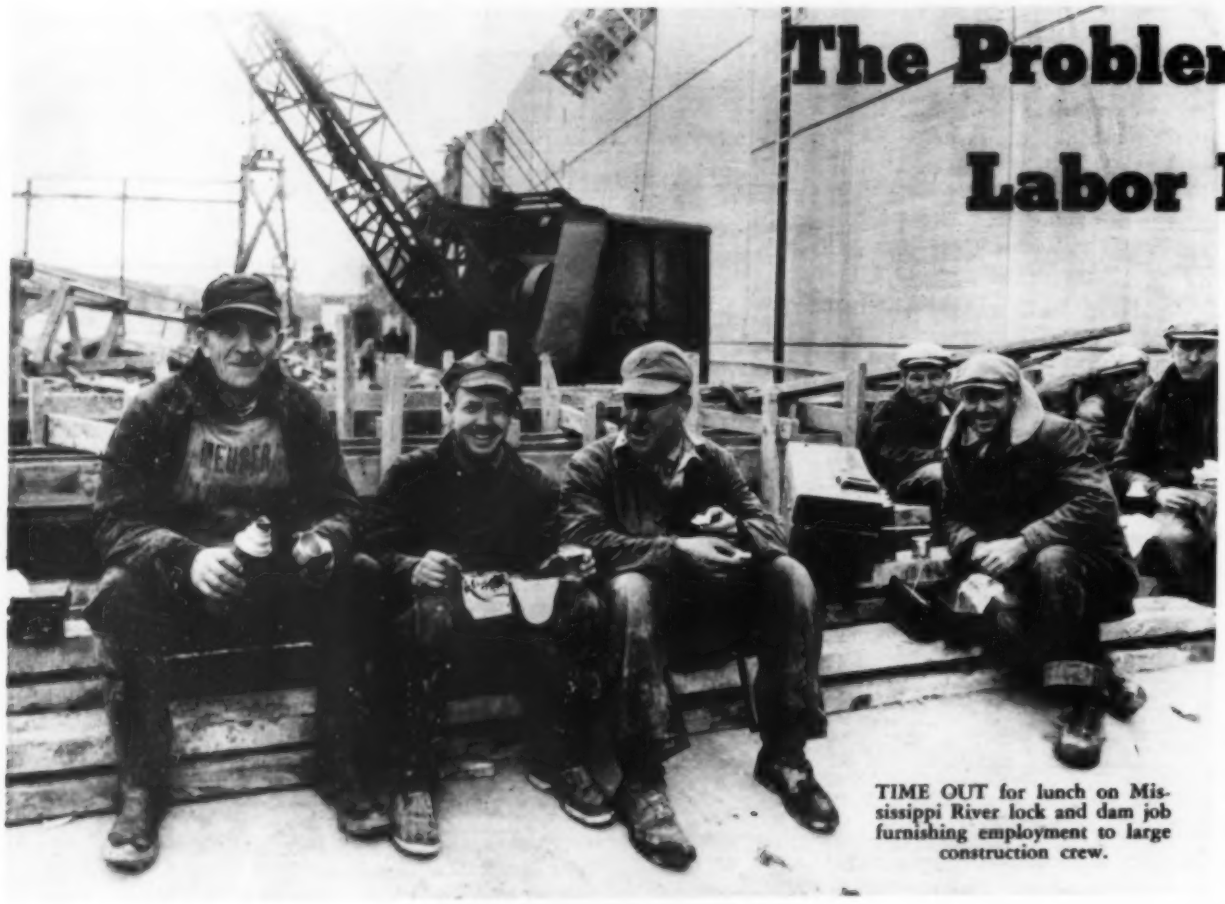


TOP SURFACE of concrete lift is cleaned thoroughly while forms are being erected in preparation for placing succeeding lift.



ROLLER-GATE BUCKET handled by fast-traveling carriage of overhead cableway delivers 3 yd. of concrete every 2½ min. on 800-ft. haul.

The Problem of Labor Relations



TIME OUT for lunch on Mississippi River lock and dam job furnishing employment to large construction crew.

Leading Contractors Discuss Article by ARTHUR A. JOHNSON New York Contractor in June Issue of CONSTRUCTION Methods and Equipment

By O. W. SWENSON

President, Foley Bros., Inc., New York, N. Y.

I HAVE READ the "Problem of Labor Relations" by Arthur A. Johnson with a great deal of interest. You could not have asked a man more qualified by experience to write on this particular problem.

At the outset, I wish to say that I agree with Mr. Johnson as to his factual statements of the situation. There is a question, however, in my mind as to the advisability of the solution suggested. If a commission is appointed and wages are arbitrarily set in localities, we might be incubating the germ of Fascism. If labor is required to work at a stated wage in which it has no voice except through its one representative on the commission, it might be possible that the same reasoning might be applied to a contractor's profit. In other words, would it not be possible for a labor representative to say that now that we have regulated the compensation of labor, why not regulate the compensation of employers of labor?

The solution that suggests itself lies in the bill which had been passed in the Senate and the General Assembly in New York State, providing that where the state or other public body is a participant in the cost of the project and where there is an increase in wages over and above that provided for as a minimum wage, then the state is required to adjust the contract prices with the contractor to take care of such increase. Assuming that this bill, which has passed both houses with only one dissenting vote, is signed by the Governor, I believe that it will offer the modus operandi for an equitable adjustment to the contractor for increases over and above the minimum wage provided for in contracts.

As a matter of fact, I am very much prejudiced against commissions. During the last four or five years we have been commissioned to death, and I would rather trust a law which clearly covers a situation than the vagaries of a body of men who, from labor, political or other motives, may be adding to the confusion of the whole picture.

Another point to be kept in mind is that the bills above referred to, now before the Governor for signature, should have the united backing of labor, as there is a mutuality of interest for both employer and employee.

By A. E. HORST

Secretary-Treasurer, Henry W. Horst Co., Inc., Buffalo, N. Y.

I HAVE READ with a great deal of interest Arthur A. Johnson's article on "The Problem of Labor Relations — And a Suggested Plan for Its Solution in the Construction Industry." I think his plan is logical and might be encouraged, at least for a trial in the State of New York. In my judgment, however, it still does not tie the labor organizations into the setup with the proper amount of responsibility.

Personally, I favor encouraging the labor organizations to make agreements with employers so that they might be made responsible for their acts. It seems to me that along this study of labor relations it is not entirely the matter of wages paid that will ultimately solve this problem satisfactorily, since there seems to be no extra premium whatever for a mechanic who is a master in his line as compared with one who has very little ability as a mechanic. It seems to me that there should be some definite standard set up covering the various mechanics used in the construction industry. Otherwise there is no incentive for a particularly good man to do better than the least skilled in his particular classification.

By H. K. FERGUSON

President, The H. K. Ferguson Co., Cleveland, Ohio

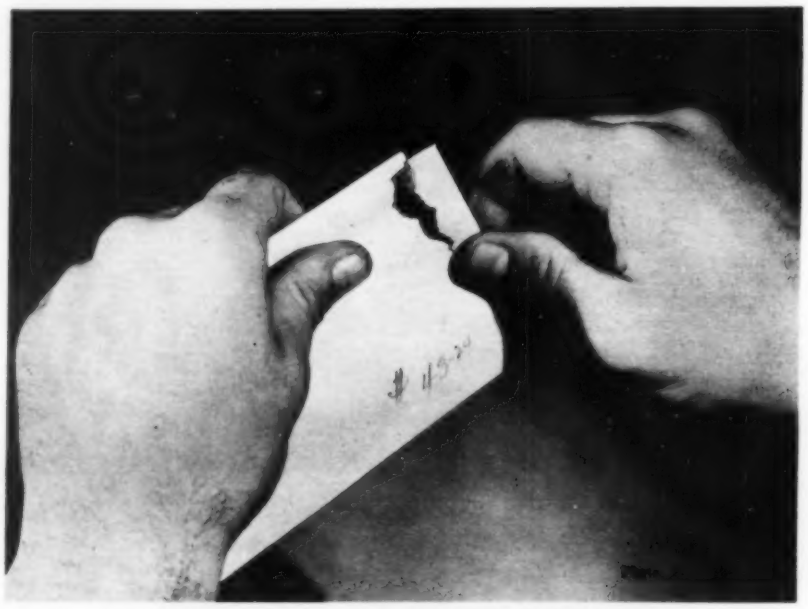
I HAVE READ with considerable interest Mr. Johnson's article on labor relations in the construction industry and in the main agree with his outlining of difficulties, and suggestions as to solution.

However, Mr. Johnson's efforts are mainly centered in the vicinity of New York City, while ours are spread out over the country from Bennington, Vermont to San Francisco. The situation generally I do not think is as bad as it is in the metropolitan section which Mr. Johnson serves.

By R. P. BAYARD

Johnson, Drake & Piper, Inc., Freeport, N. Y.

ARTHUR JOHNSON'S ARTICLE on "Labor Relations" has clearly and ably stated exactly our feelings in the whole matter. We have been anticipating trouble ever since the C.I.O. started its attempt to organize the construction field. We heartily agree with Mr. Johnson's proposed solution, but believe it will be a tremendously difficult matter to get either the union leaders or the politicians with labor-vote leanings to give up a plum of such tremendous proportions. It would require, in my opinion, a fearless and united uprising of all those elements



PAY ENVELOPES produce bigger returns than strike benefits.

now being exploited namely, the public, the workmen and the contractor.

I believe the solution suggested by Mr. Johnson is far superior to the present arrangement, even though the unions were made accountable and responsible for their acts, as we very probably would still have the problems of two unions contending for supremacy, and the public, the workmen and the contractor, holding the bag.

By JOSEPH V. HOGAN

President, The Arundel Corp., Baltimore, Md.

I HAVE READ with a great deal of interest the article by Arthur A. Johnson. The article is timely and expresses the sentiments, to the best of my knowledge, of the majority in the construction industry.

By H. W. MORRISON

Vice-president and general manager, Morrison-Knudsen Co., Inc. Boise, Idaho

THE PROBLEMS of the contractors of the West and wide open spaces are perhaps not the same as those which exist in the large industrial centers of the country. Our labor problems, while basically similar, are quite different in view of the fact that labor organizations are not in a position to organize as effectively as they are where it is possible for them to deliver the collective votes of their membership for the benefit of a particular group of politicians.

If we are, in fact, to be regimented entirely in the management of our respective businesses, then no doubt the suggestions as offered by Mr. Johnson are timely and fully in order. There is, however, a theory among some of us that labor can best prosper and industry can proceed in a more orderly manner if the problems of wages and working conditions are subject to negotiations between an employer and his men directly, and not through domination of a Labor Relations Board in Washington or hired employees of the labor unions whose salaries and remuneration remain constant, whether the men are on strike or whether they are on the job.

As far as our company is concerned, we have had very little labor trouble of any sort during the 25 years in which we have been in business. In my opinion, this is due to the fact that our work has been located away from the large centers and where it is possible to get on a more personal basis with our employees and work out the differences and the questions involved before they become magnified into questions involving major disputes.

Should there be an enactment of the type of legislation recently suggested by the President, wherein he proposes to fix wages and working conditions for everybody and force everyone to join a union whether they desire to do so or not, and pay dues which, as pointed out by Mr. Johnson, are excessive and which are in part turned over to help finance political campaigns, then we must revamp entirely our approach to the handling of our workmen generally. In the event of a culmination of this plan of regimentation we must, all of us, operate by a set of rules dictated by Washington and no individual treatment of our labor problems will be possible.

LINES OF CONSTRUCTION WORKERS form every Friday morning to receive pay on Grand Coulee dam project in Washington.

STRIKERS cheer settlement at tractor plant.

It is my observation generally among the men in the employ of our company that they desire to work as they always have in the past, i.e., on a basis whereby they can feel free to go to the management and talk about their problems and obtain an immediate and prompt settlement and adjustment in connection therewith, without the necessity of going through outsiders and paid organizers who have a selfish interest in magnifying the differences in an effort to exploit the employees as well as the employers.

It seems to me that contractors, as such, are being placed in a very precarious position by the legislation which has been enacted and that which is proposed, inasmuch as we do not have any basis by which we can obtain an increase in compensation for our work after the job is bid, but are at the same time continually subject to the possibilities of unreasonable demands being made as a result of agitation by labor organizers which the Labor Department at Washington aids and abets and supports without offering any protection whatever to the contractor who has made a firm bid and must complete his job at the prices stated, regardless.

I am of the opinion that a situation could arise such as to preclude the contractors' making reasonable tenders on the very large volume of work contemplated throughout the country, unless the Departments at Washington are willing to insert in contracts some protective clause which would shield the contractor from continued and unreasonable demands for wage increases over and above the schedules specified when the proposal is submitted and accepted.

By A. B. MACMILLAN

Chief Engineer, Aberthaw Co., Boston, Mass.

I AM IN hearty agreement with Arthur A. Johnson in the wish that something might be done to eliminate the many differences that seem to arise so often between employers and employees and the many interruptions to work caused by these differences and by quarrels between various labor organizations themselves over jurisdictional disputes. I cannot, however, get up any enthusiasm over his suggestion to place the handling and settling of such matters in the hands of any governmental body or commission. It seems to the writer that the constant cry in this country today when problems and difficulties arise is for the government to set up a law or a commission to settle the situation arbitrarily. If we continue to ask for such laws and commissions we can only blame ourselves if the government eventually takes us at our request and regiments us into a first-class socialistic state where individuals as such and businesses as such have no say at all in their own affairs, but carry on in all matters strictly according to governmental edicts.

I believe the alternative Mr. Johnson so briefly suggests, namely, the requirement of legal and financial responsibility for their acts on the part of all labor organizations, is the thing

Photo, Underwood & Underwood

STRIKE GATHERING is broken up by police.

that is really necessary. We must not, however, think that this would eliminate all disputes between employers and labor or make the business of contracting any Sunday school picnic. It wouldn't. Differences exist today in family relations, in the relations between business organizations; they always have and probably always will. They would not be nearly so numerous, however, between employers and labor organizations if labor organizations were required to establish themselves as corporate entities with some reasonable amount of financial worth so that when they entered into agreements they could be made either to live up to the agreements during their stipulated periods or be held liable financially for the damages caused by their failure to do so. Employers are required to have such responsible standing on their part. Is it, therefore, unreasonable to demand that employees, when they group together for the purpose of collective bargaining with employers, should also be required to have similar responsible standing?

Beyond that requirement, if we are well advised and have real desire to retain some of the liberty our forefathers endeavored to provide for us, we will not encourage the government to intervene.

By ALLEN W. GRANGER

Secretary, Mason & Hanger Co., Inc. New York, N. Y.

AS USUAL, Mr. Johnson is able to state his case in a very convincing manner because he sticks to facts and to logic, and further than that, he is always eminently fair and unbiased. The pity of it is, however, that articles such as this, as well as sane and sound editorials in the various publications written by intelligent and fair-minded men, do not reach the people whom they would most benefit and, by so doing, bring about the influence for general good which they are intended to do. You see in this particular case what I mean. CONSTRUCTION *Methods and Equipment* contains an article expounding ideas and suggesting a procedure that is in entire accord and agreement with the thoughts and ideas of its readers who are, in fact, at least 95 per cent sold on the subject before ever reading the article.

On the other hand, we have a great amount of propaganda handed out through the various media that go to the so-called masses, containing a lot of sophistry and specious argument and based upon prejudice and selfish interest, that is being absorbed by the great majority of the labor classes, to their own great detriment.

By L. E. RAY

The Diamond Engineering Co., Grand Island, Neb.

WITHOUT A DOUBT, the subject of labor is the toughest and the most disturbing problem confronting the construction industry today. Further, it is a problem that must be solved if the industry is to go forward with the work of the nation. We find, on one hand, working men who complain that they cannot make a living, yet who pay exorbitant organization dues; and, on the other hand, we find employers paying wages in some cases double or triple what was paid a few years ago for one-half the labor accomplishment.

Mr. Johnson touches the real root of the question when he suggests that "the unions place themselves in a position that they can sue or be sued and have damages levied for or against them; then there will be little, if any, necessity for any change." Authority without responsibility is a dangerous thing. As an alternative, it will be necessary to have some kind of state board or commission whose findings will be binding on both parties, and, of course, subject to appeal to the proper courts.

A great responsibility seemingly rests lightly on the shoulders of the present labor leaders who, everybody concedes, are in power today. It behooves the laborer himself to watch his hole card, for the present trend, carried to its conclusion, will result in a labor dictatorship that will be anything but desirable from the laborer's standpoint. As conclusive proof of this statement, I simply point to the condition of labor in several European countries, for who has heard of high wages or strikes in Russia, Germany or Italy?

In conclusion, it is my opinion that, before any lasting solution is reached, labor and the employers must meet on the common ground of equal responsibility to each other and their customers, the public, and to that end we should bend all our efforts.

By OSCAR B. COBLENTZ

President, Merritt-Chapman & McLean Corp., Baltimore, Md.

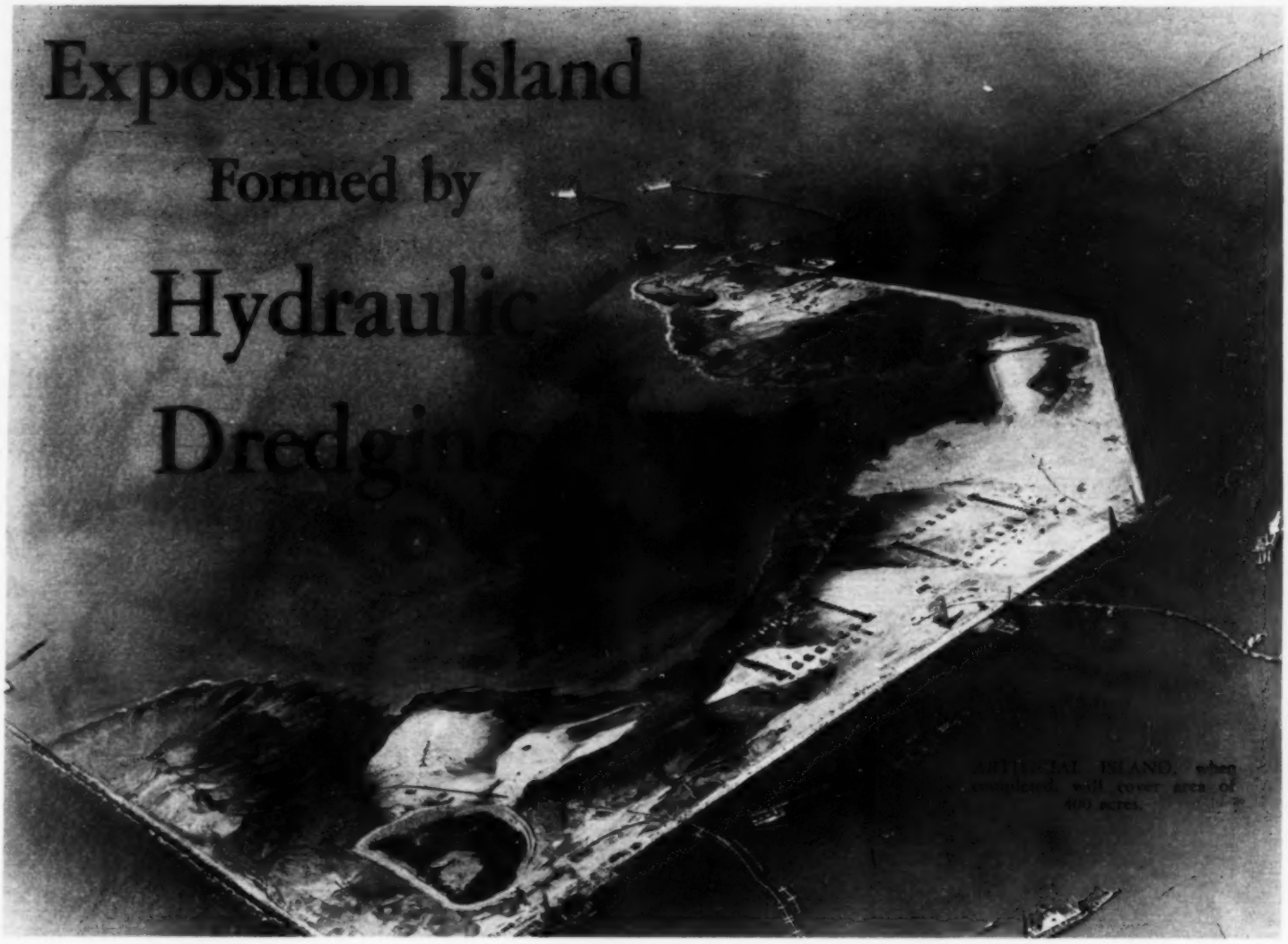
UP TO THE PRESENT time our company has operated in territory where the competition has been non-union for the construction of engineering projects which we have generally undertaken. The PWA has classified occupations as skilled, semi-skilled and unskilled, and established minimum rates of pay for occupations listed under these three heads. The PWA Board of Labor Review usually compels the contractor to pay the rates for the specified occupations, regardless of whether or not the work was done by a skilled workman or by an unskilled workman. As a practical matter, however, if a man rated as a carpenter were given a task, classified as unskilled, he could not be paid the unskilled rate, even though he was willing to accept the unskilled rate for a short period, without having his official classification changed. On the other hand, if an unskilled workman were given work to do that was classed as skilled, the contractor was required to pay this unskilled workman at the skilled rate.

The type of organization sponsored by the C.I.O., which Mr. Johnson mentions, apparently attempts to follow the type of organization sponsored by the PWA, to some extent, but requires the workman to accept the rate of pay established for the particular type of work he does from day to day.

The application of the Wagner Act will undoubtedly make it necessary to work out some simple and inexpensive plan of cooperation between the employer and the employee. While the plan suggested by Mr. Johnson may be revolutionary, it should receive unbiased and careful study by all parties.

MESS HALL at Boulder dam accommodates construction workers of Six Companies Inc.

Exposition Island Formed by Hydraulic Dredging



TO PROVIDE a site for the Golden Gate International Exposition in 1939 a 400-acre man-made island in San Francisco Bay is being created by hydraulic dredging and sea-wall construction involving the placement of 25,000,000 cu.yd. of hydraulic fill and 280,000 tons of rock. The project, being carried out under the direction of the Corps of Engineers, U. S. Army, is financed by a WPA allotment of $3,803,900 and will provide a filled area on the Yerba Buena shoals, alongside the newly completed San Francisco-Oakland Bay bridge, 5,520 ft. long and 3,400 ft. wide, which will serve ultimately as a permanent airport.

A fleet of 9 dredges is delivering about 3,500,000 cu.yd. of hydraulic fill per month to the island site north of Yerba Buena Island where water depths range from 2 to 26 ft. Three hopper dredges of the U. S. Engineer Department started work in February, 1936, moving material from the Alcatraz and Presidio borrow areas. A short time afterward the suction dredge "Sacramento" began pumping fill to the northwest corner of the island project.

According to original plans, government equipment was to be used until plans and specifications had been prepared for calling for bids March 10, 1936, on filling the entire site and constructing a 3-mi. long rock seawall. As no bids were received, the U. S. Engineers made preparations to carry out the hydraulic fill work under their own supervision, using both government-owned and rented dredges. Of the fleet of 9 dredges, 7 are powered by steam, 2 by diesel-electric and 2 by electric equipment. The hopper-type dredges are sea-going vessels and usually operate in the vicinity of the fill, pumping material from adjacent shoal areas into hoppers located amidships. When filled the dredges return to deposit their loads near the suction dredges for transfer to the island site through a system of piping.

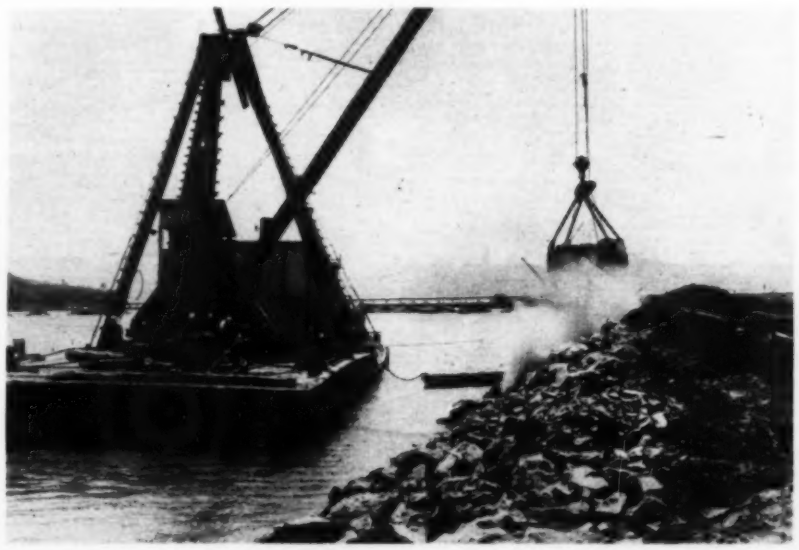
The sand and gravel on the bay floor is excavated by rotary manganese-steel cutter heads and pumped to the site through steel pipes resting on steel pontoons or pile trestles. Material thus discharged averages about 14 per cent solids. Dredging operations are on a 24-hr. basis, but no work is done on Sunday.

The rented dredge "Marshall Harris" is operated under a bonus-penalty system, the monthly output, as specified under the contract, being 450,000 cu.yd., an amount that has always been exceeded. Rental is for a period of 10 months and electric power, paid for by the government, is brought to the dredge by a submarine cable. Dredges "Hindes" and "Tualatin" were rented for 3 months, with options to extend this period. Power is supplied by the contractors and the rental basis is hourly.

Monthly capacities of the dredges at work at the Exposition site are as follows:

Dredge	*Cu.Yd. Per Month*
Tualatin	1,250,000
Marshall Harris	650,000
Multnomah	400,000
Culebra	475,000
Mackenzie	400,000
Kingman	375,000
Sacramento	400,000*
San Joaquin	400,000*
Clatsop	225,000
Hindes	550,000

(*275,000 cu.yd. when on long lines with hopper material)

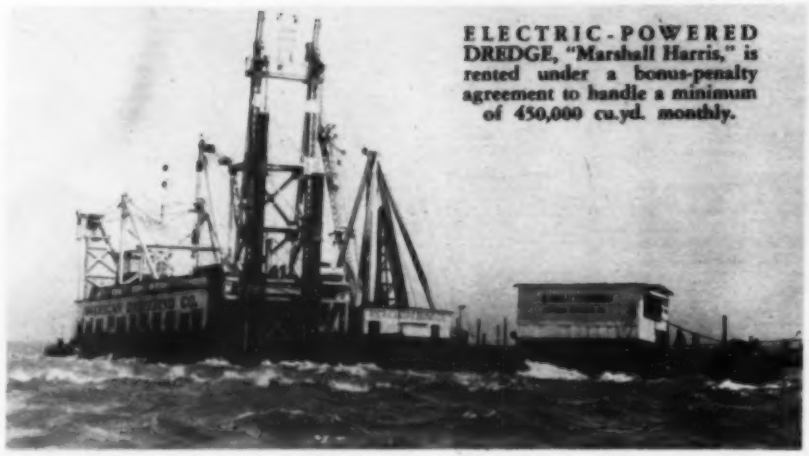


SEAWALL, 3 mi. in length, is built of rock placed by clamshell cranes on scows.

Dredging operations started at the relatively shallow southwest corner of the site, and since then the fill has been placed progressively toward the north end which will not be inclosed in the rock seawall until near the finish of the project. This is being done to allow the sand fill to displace the softer material and push it out of the north end of the area, rather than to confine it within the site proper. In addition, a wide trench is to be excavated to El.-45, which will be backfilled with heavier material. During the early stages of dredging and before construction of the seawall had been start-

ed, only about 75 per cent of the material pumped by the dredges was retained. This figure rose with the advancing rock wall until it stands at a maximum of about 90 per cent. The material excavated by the dredges from the Presidio, Alcatraz, and Knox shoals is a good grade of sand and gravel, portions of which weigh as high as 138 lb. per cubic foot.

Seawall — The seawall is being built under contract by the Marinap Corp., of San Francisco (Basalt Rock Co., Blake Bros. Co., Daniel Contracting Co., and Hutchinson Co.). The bid submitted by the corporation was $278,000. Tonnages, bid prices and general specifications for the rock are as follows: Class A, 61,000 tons at $1.75; Class B, 58,000 tons at $1.25; and Class C, 90,000 tons at $1.10. Weight of the pieces of Class A rock is from 500 lb. to 3 tons each; Class B from 3 lb. to 1,000 lb. each; and



ELECTRIC-POWERED DREDGE, "Marshall Harris," is rented under a bonus-penalty agreement to handle a minimum of 450,000 cu.yd. monthly.

per-bottom dump barges, which place the rock for the first lift directly in the wall, without rehandling. In general, however, most of the material is deposited by clamshell cranes mounted on scows and operating along the line of the walls.

The clamshell dredges work intermittently for dressing the side slopes to grade for the rock wall. Material placed previously in the fill is pushed behind the rock wall by bulldozers. In this manner the area behind the walls is extended rapidly, with consequent quiet water and more efficient hydraulic fill operations.

Construction of the rock wall begins at El.-6 ft. below mean low water at the border of the hydraulic fill, which takes a slope of 1 on 6. Class C rock is used on the first lift from El.-6 to El.+2, followed by subsequent lifts of Class B rock until El.+14 is reached. The westerly and northwesterly sections of the seawall exposed to considerable wave action during storms are provided with a 4-ft. layer of Class A rock on the outer slope of the wall which is 1 to 1½. The walls on the easterly side of the site are constructed entirely of Class B rock.

On Jan. 1, 1937, the island was more than two-thirds complete with more than 12,500,000 cu.yd. in place out of the 20,000,000 cu.yd. required in the backfill area. The seawall surrounding the island was about 85 per cent complete.

Work is also progressing on a causeway connecting the island site with Yerba Buena Island. Total length of the causeway is 900 ft. and top width 110 ft. The side slopes are 1 on 2, and the elevation varies from 52 ft. at Yerba Buena Island to El.+13, the finished surface of the Exposition site. When completed the causeway will contain a permanent 32-ft. width of highway, to which will be added another 32 ft. of temporary width for the duration of the Exposition. To minimize the height of the side-hill cuts, the temporary roadway will be built on a trestle outside the permanent highway. Thus a 6-lane highway will be

DREDGE FILL *(in oval)* is spread by tractor - mounted bulldozer.

those of Class C from fines to about 400 lb. each. The rate of placement under contract is set at 40,000 tons per month. Rock is obtained from several quarries in the bay area and transported to the site on barges.

Here various methods are used in placing the different grades of rock. Some contractors are employing hop-

DISCHARGE PIPE from hydraulic dredge is supported on wood trestles to place fill behind rock seawall.

available during the Exposition, and a 3-lane highway as a permanent facility.

The Golden Gate Exposition's Department of Works is headed by William P. Day, with J. J. Walsh as chief of the Division of Reclamation. Plans for the construction of the island site were prepared by the Corps of Engineers, U. S. Army, the work being executed under the direct supervision of Lieut. Col. J. A. Dorst; Capt. F. B. Butler, is chief of operations and F. E. Frey is engineer in charge of field operations.

Anson Blake is president, and K. H. Mead is superintendent of field operations for Marinap Corp.

CAUSEWAY *(left)* is being built to connect Exposition island site with Yerba Buena Island.

JOB ODDITIES

A MONTHLY PAGE OF

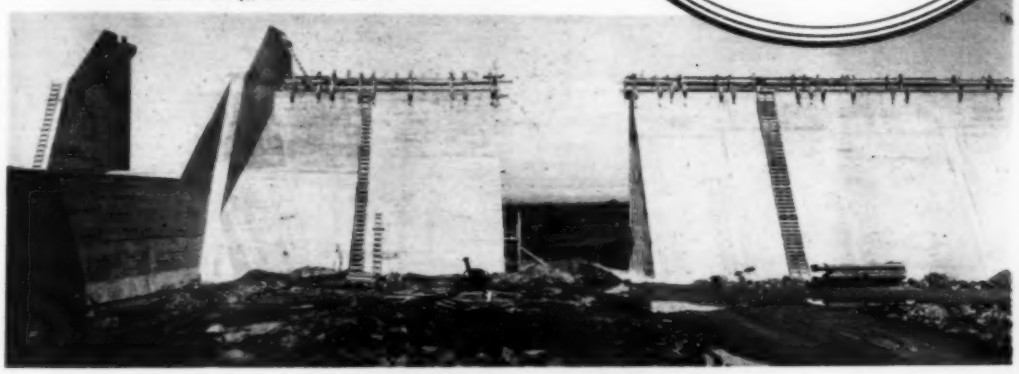
Unusual Features of Construction

CELLOPHANE WRAPPING

is applied, as advertising stunt, to new residence at Manhasset, Long Island, N. Y., constructed by Levitt & Sons, New York builders. With appropriate ceremonies "packaged" house was opened by pulling world's largest zipper, 12 ft. long, at front door.

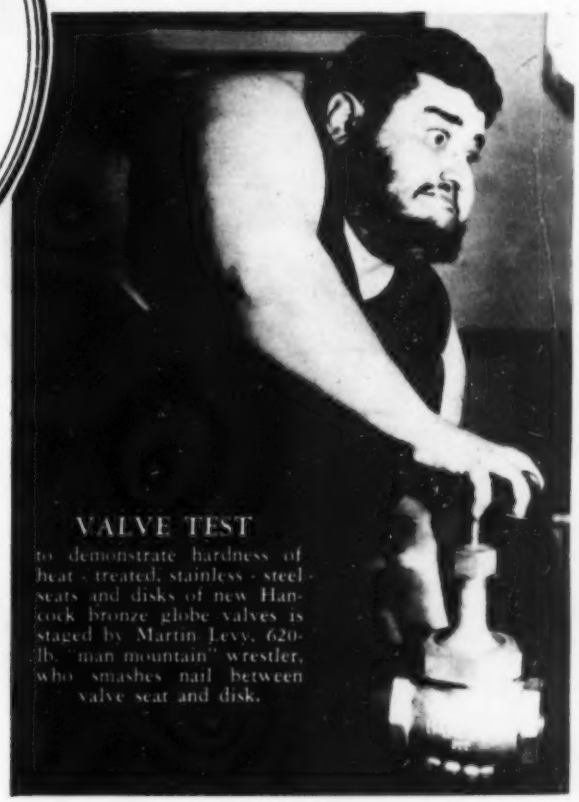
SHEEPSFOOT TAMPING

by both natural and mechanical means is shown side by side, on earth dike at Cajalco dam, under construction for Metropolitan Water District of Southern California.



"INJUNCTION SLOT"

in north gravity section of Buchanan dam on Colorado River near Burnet, Tex., is left in structure to satisfy injunction obtained by local utility interests ordering Lower Colorado River Authority, builder of dam, to leave opening of prescribed width and sill elevation. After court order has been terminated, slot is closed.



VALVE TEST

to demonstrate hardness of heat - treated, stainless - steel seats and disks of new Hancock bronze globe valves is staged by Martin Levy, 620-lb. "man mountain" wrestler, who smashes nail between valve seat and disk.

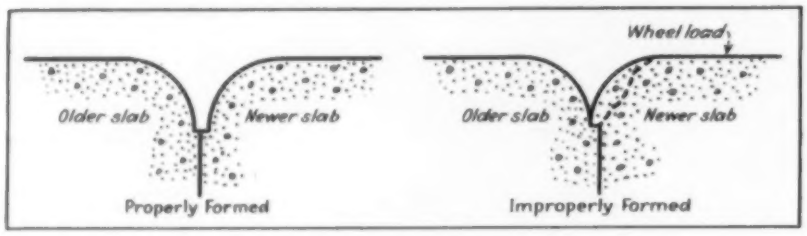
"Waiter, bring me a short beer!"

CAT'S WHISKERS

(right) eliminate electric shock to motorists on San Francisco - Oakland Bay bridge in California when they pass coin to toll collector. Flexible steel strip, contacting front bumper, grounds static charge generated by moving car.

Dont's FOR CONCRETE HIGHWAY BUILDERS

THE accompanying illustrations are selected from a paper "Desirable Improvements in Concrete Highway Construction," by Prof. Charles B. Breed, of the Massachusetts Institute of Technology, presented at this year's annual convention in New York City of the Association of Highway Officials of the North Atlantic States.



1] Proper and Improper Longitudinal Joints

Left hand sketch shows properly formed joint where roundings on slab edges are symmetrical with respect to vertical joint between slabs. Older slab is one first poured and newer slab is one which was poured against older slab, latter serving as a form.

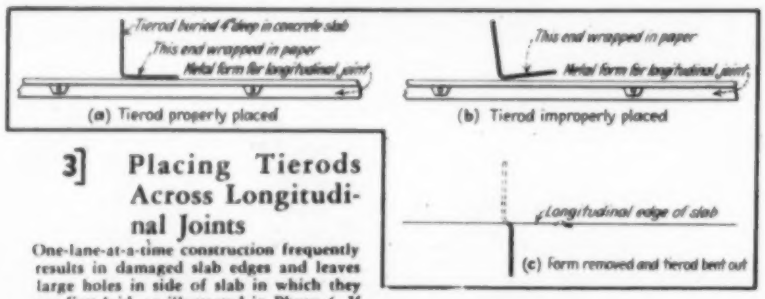
Right hand sketch shows an improperly formed joint where concrete of newer (second) slab has been allowed to overlap older (first laid) slab leaving overhanging lip of concrete resting in groove left by rounding tool on first slab. These overhanging joints are a common fault of "one-lane-at-a-time" construction, where first slab is laid and its longitudinal edges rounded by using steel form as guide. Form is then removed, and at a later date adjacent slab is poured against first one, using it as a form; in this process concrete of newer slab flows over rounded edge of older slab and covers vertical joint between slabs. Finisher no longer has any definite face to guide him in forming joint edge, and he has to use his judgment as to just where longitudinal edge of new slab should be formed. As a result, he naturally forms an overlapping joint rather than a vertical one because in so doing less concrete need be displaced at joint edge.

Overhanging lip of concrete on newer slab spalls off along dashed line shown on sketch, causing defective condition illustrated in Photo 2.

2] Typical Longitudinal Joint Spalling Caused by Overhang

Rounding on right-hand slab was formed so that it overlapped that on left-hand slab. Knife shows how upper part of joint was inclined. Overhanging lip of concrete has sheared off leaving ugly break shown.

Shearing effect may occur in several ways: Truck on overhanging slab will tend to deflect this slab below its neighbor causing it to bear down on overhanging lip of concrete; settlement of newer slab will also cause it to be "hung up" on overhanging portion; heaving of older slab will frequently cause it to rise slightly above overhanging slab, thus forcing off overhanging lip of concrete. Latter effect was apparently responsible for spalling illustrated above — but if there had been no overhang, small movement which took place would not have been detected and no damage would have resulted.


Tierod buried 4" deep in concrete slab
This end wrapped in paper
Metal form for longitudinal joint
(a) Tierod properly placed
This end wrapped in paper
Metal form for longitudinal joint
(b) Tierod improperly placed
Longitudinal edge of slab
(c) Form removed and tierod bent out

3] Placing Tierods Across Longitudinal Joints

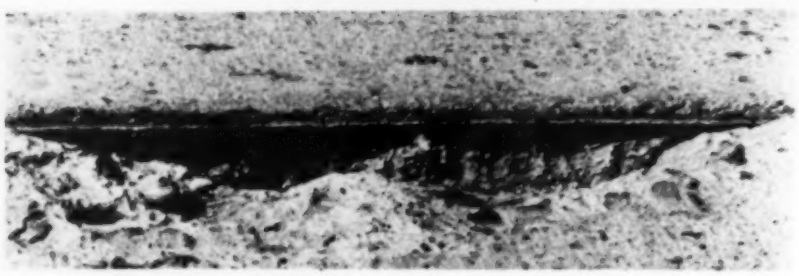
One-lane-at-a-time construction frequently results in damaged slab edges and leaves large holes in side of slab in which they are first laid, as illustrated in Photo 4. If these holes are not patched, they will become filled with concrete from adjacent slab forming bulges on that slab which often cause large portions of older slab to spall off as illustrated in Photos 5 and 6.

4] Handling Tierods Across Longitudinal Joints

Tierod partly bent out showing hole left in side of slab. Edge of slab above rod has been chipped in locating and prying out rod.

5] Spall Next to Joint

Large spall next to longitudinal joint resulting from method of placing and recovering tierods. Steel rod was originally bent 90 deg. in middle and embedded in right-hand slab with one leg against form on this slab. Form was removed and rod bent out straight leaving hole in side of right-hand slab. Left-hand slab was then poured and fresh concrete flowed into hole in right-hand slab keying them together at this place. Lip of concrete thus formed has forced off edge of slab above it causing fracture shown in photograph. Piece of concrete broken out will continue to spall and be displaced until large hole develops as shown in Photo 6.



6] Bulge in Slab

Bulge in newer (upper) slab where concrete of this slab flowed into hole left by tierod in older (lower) slab. Older slab was supported only at this one place by newer slab, which caused concrete over protruding bulge to spall under traffic loads as shown in photograph.

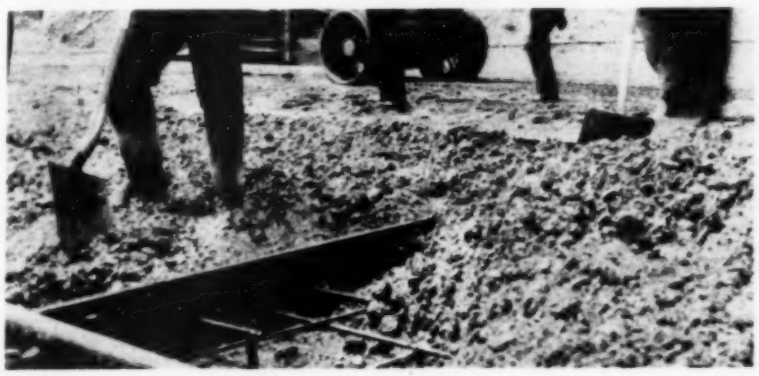
7] Form Setting

Forms blocked up to grade by placing bricks or stones or mounds of earth under them at intervals. When subgrade is shaped and compacted material placed under forms will not be well compacted and forms will still be bearing on few bricks and stones shown in photograph. When heavy finishing machine passes over these forms, they will be depressed permanently producing pavement which is thinner than that for which forms were set. Even though forms are supported throughout their length, unless thoroughly tamped with steel tampers, they will depress on passage of finishing machine.

8] Transverse Joint not Vertical

As finishing machine approached this transverse joint pins supporting joint filler were pulled leaving filler partially supported by freshly placed concrete. Concrete on left was compressed by finishing machine before that on right, causing filler to be inclined forming a slanting joint.

This defect can be avoided by leaving pins in place until after first passage of finishing machine; they should then be pulled out and holes filled with fresh concrete. Second passage will smooth out these places, but will not exert sufficient pressure to change position of joint as it passes over it.



9] Placing Concrete at Transverse Joints

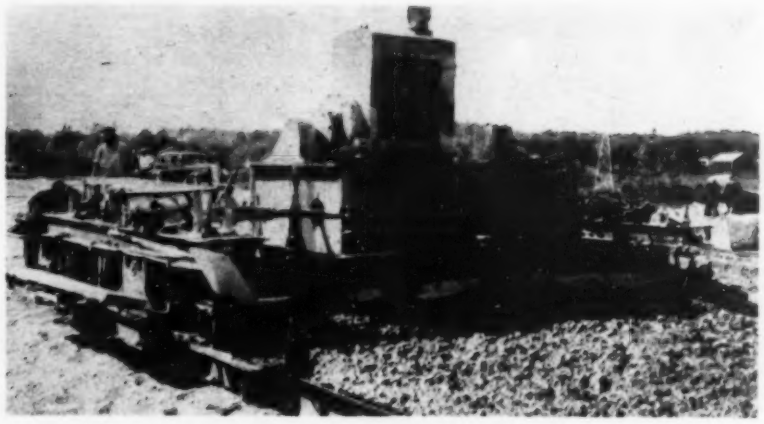
It is essential that uniform, durable concrete be obtained at transverse joint edges, as these are most vulnerable parts of slab both with respect to traffic wear and disintegration due to frost action. Well-mixed concrete of uniform consistency should be hand placed in equal amounts along each side of these joints, so that when finishing machine passes over joint there will be no accumulation of excess mortar or laitance (soup) which will form weak concrete and result sooner or later in a disintegrated joint.

10] Gravel Pit

Within range of this photograph nature of deposit varies from fine powder to coarse gravel. Steepness of bank indicates presence of cementing agent, probably clay, and plenty of overburden is scattered through pit. From pit of this kind it is almost impossible to maintain consistent and uniformly graded product from washing and grading plant, such as is essential for concrete of uniform strength and durability. Much of non-uniformity which develops in pavements in service traces back to pit where materials were produced.

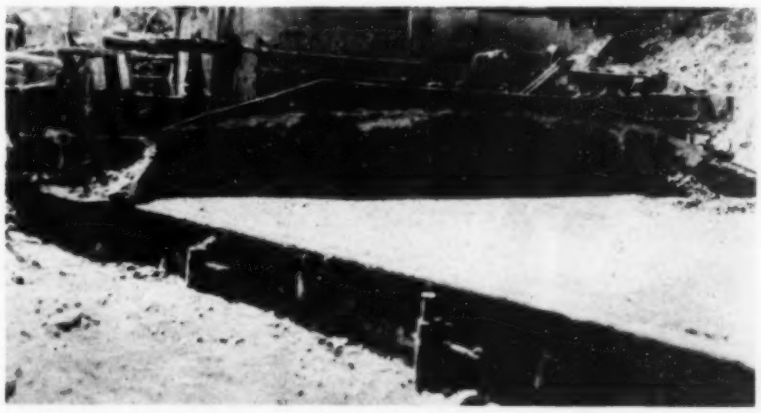
11] Non-Uniform Concrete

Concrete in left lane is evidently inferior to that in right lane, yet materials came from same pit, and same methods were used in mixing and placing. These slabs are located in advance of traffic light and receive frequent applications of sand and calcium chloride in winter maintenance. Right-hand lane could "take it," left-hand lane could not.



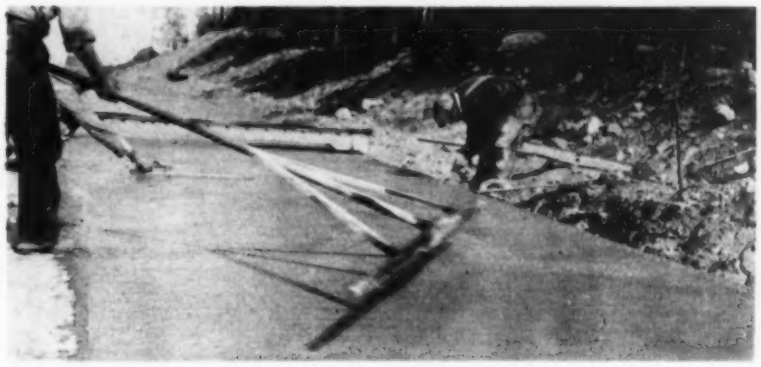
12] First Passage of Finishing Machine

Best preventive against scaling is to produce uniform, dense concrete right up to surface and to avoid producing in finishing process surface layer of mortar that is likely to scale. Two passages of finishing machine should be sufficient for obtaining true surface. Wave of concrete before front screed should be of same consistency as that in slab — free from any evidence of excess moisture. Photograph shows first passage of finishing machine over mix of proper consistency.



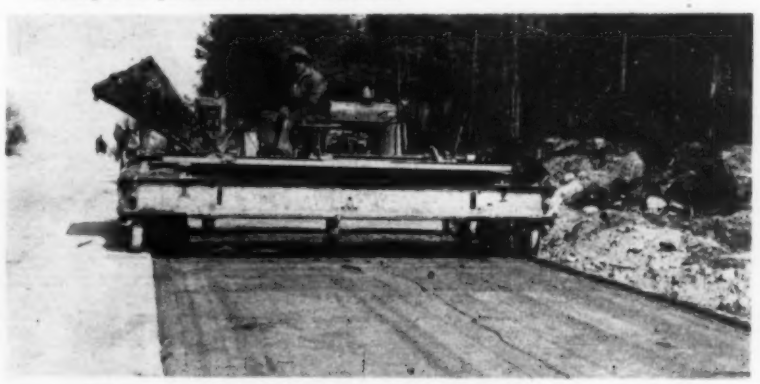
13] Second Passage of Finishing Machine

Second passage of finishing machine should shave off surface to proper contour without producing wave of "soup" before screed. In photograph, note small amount of concrete in advance of screed and total absence of excess water.



14] Final Finishing With Straight-Edge

After finishing machine has completed its work final smoothness is obtained by means of longitudinal float or long handled squeegee as shown in photograph. Less surface is disturbed the better. Simple straight-edge shown will give good results if it is used to level off high spots, but should not be used to fill in depressions with excess mortar and laitance. If latter form on surface they should be scraped off pavement and over side-forms.



15] Spreader for Transit-Mixed Concrete

This machine functions well in spreading fine-mix top course on this two-course pavement. Similar machine proved unsatisfactory in spreading transit-mixed base course of coarser mix. Concrete became honeycombed on subgrade, particularly at transverse reinforcing rods, causing planes of weakness in slab which led to excessive transverse cracking over rods after pavement had been in service a few years.

Open Concrete Caissons

Sunk through Clay

By L. F. BOOTH

Field Engineer,
H. J. Deutschbein Co., Inc.,
New York, N. Y.

AS PART of the substructure work for an addition to the power station of the Cincinnati Gas & Electric Co., at Columbia Park, Ohio, the H. J. Deutschbein Co., Inc., constructed a series of reinforced concrete caissons, each for the support of two columns, by methods illustrated in the accompanying series of photographs. Sargent & Lundy, Inc., of Chicago, served as consulting engineers on the project.

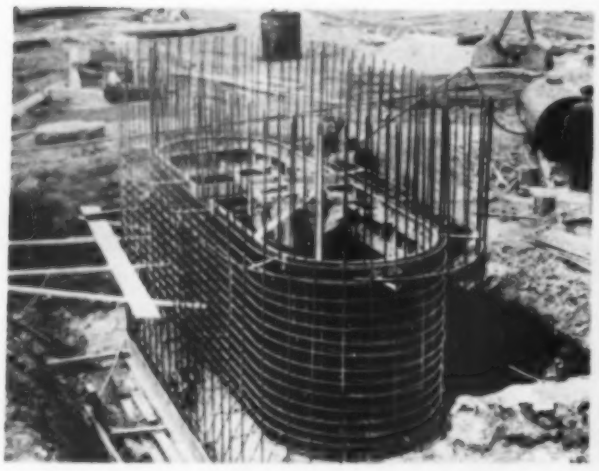
The caissons are oblong, 10 ft. wide with round ends of 5-ft. radius, and vary in length from 24 to 31 ft. In depth they range from 48 to 55 ft. and are sunk through 30 or 40 ft. of clay and 10 or 15 ft. of sandy clay into sand-and-gravel bearing strata.

Upon a steel cutting edge, set to line and blocked up level, outside forms and collapsible core forms are erected and steel reinforcing set for the first 10-ft. lift of concrete forming the caisson walls. Concrete is then poured from a bottom-dump bucket and, when set, forms are stripped and the foregoing operations repeated. Material within the caisson is dredged out, between concrete pours, with a clamshell bucket. The caissons usually were constructed in six lifts, concreted and sunk alternately except for the first two lifts, both of which were poured before the blocking was removed.

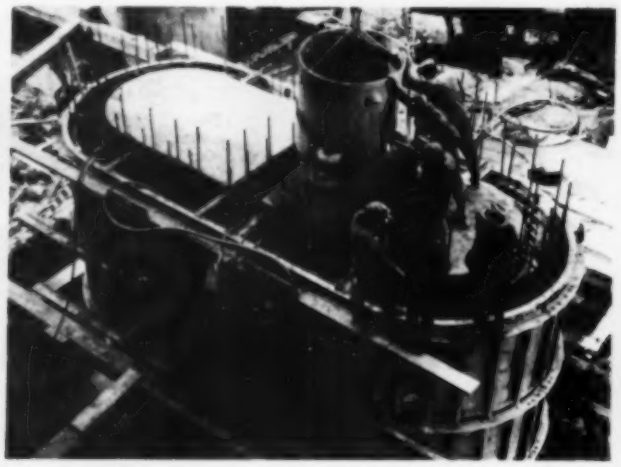
The final operations consisted in pouring a concrete seal in the bottom of each caisson by means of submarine buckets and placing a 6-ft. solid concrete cap on top of each caisson.

1 CUTTING EDGE is set level and to line on blocking after preliminary excavation is completed. Blocking is cut out after 20 ft. of caisson (two 10-ft. lifts) is concreted and sinking started.

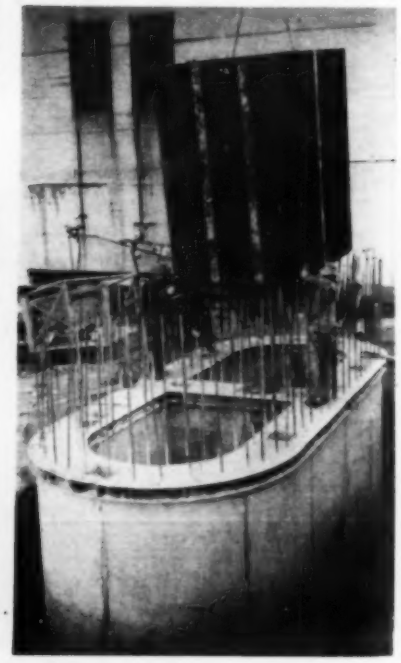
2 FORMS ERECTED on cutting edge and threaded rods connected to form start of vertical reinforcing.



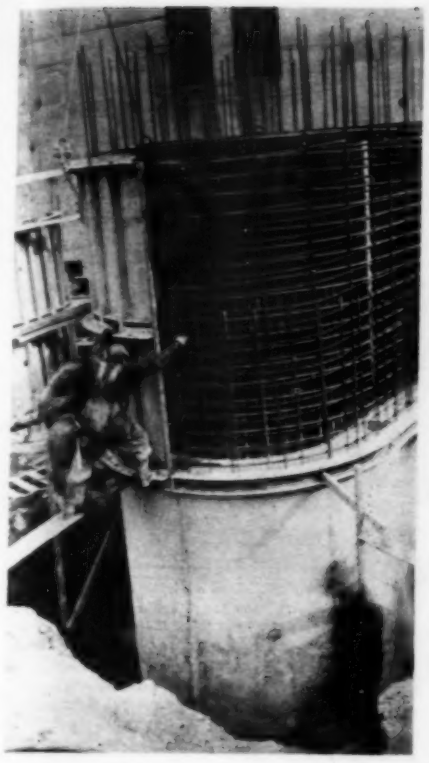
3 COLLAPSIBLE CORE FORMS are in place and steel reinforcement is set for first 10-ft. concreting lift.



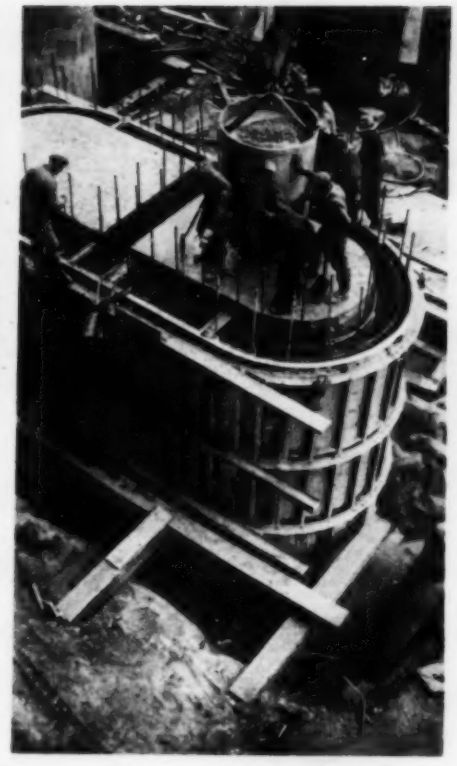
4 EXTERIOR FORMS are erected and concrete for first lift is being poured from bottom-dump concrete bucket.



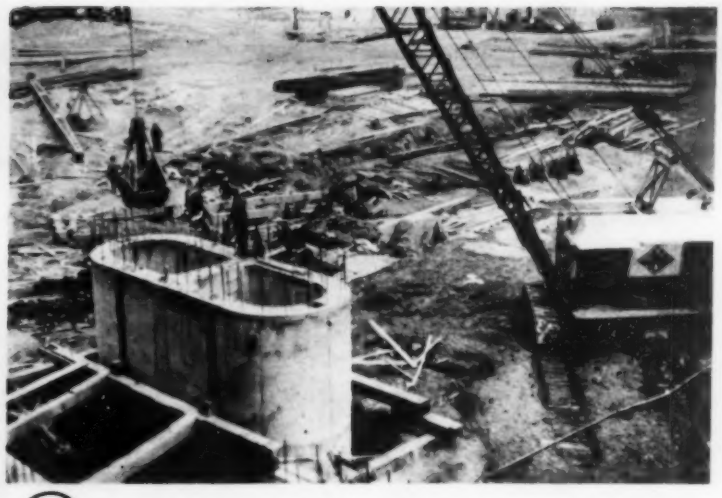
5 STRIPPING of exterior forms is completed and interior core form is being hoisted out of caisson.



6 SECOND LIFT is started by placing interior core forms, steel reinforcement and exterior wall panel forms.

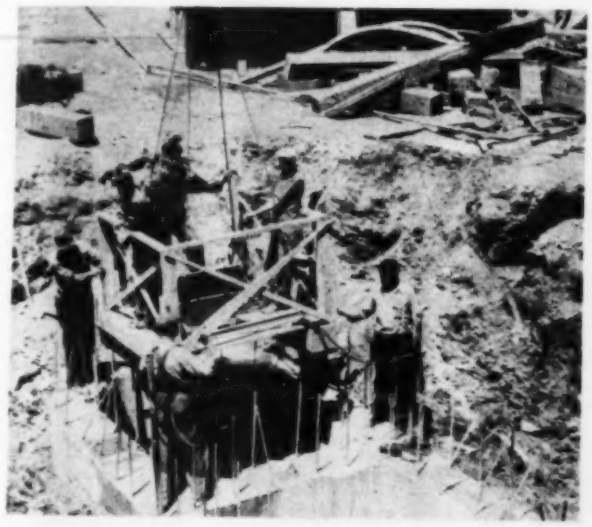


7 SECOND LIFT CONCRETING in progress. Caissons usually consisted of six lifts concreted and sunk alternately, except for first two lifts which were poured before blocking was removed.



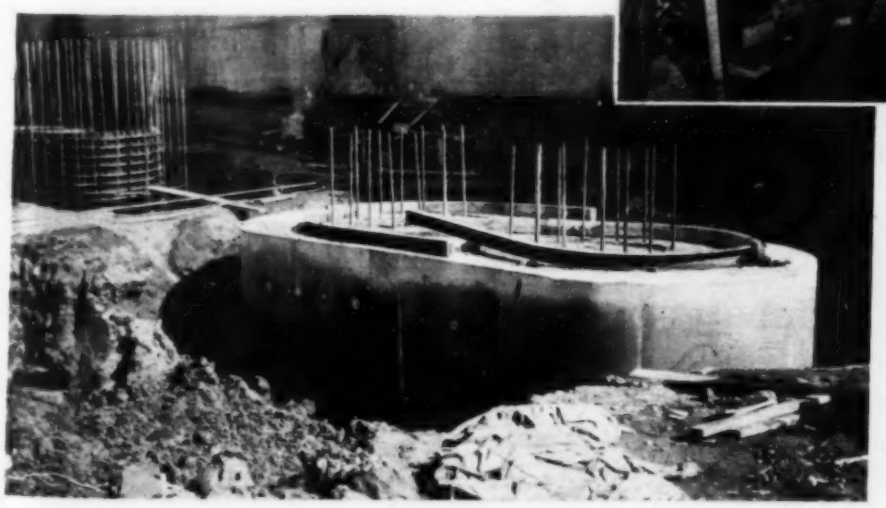
8 SINKING of partially completed caisson is accomplished by dredging out interior, between concrete pours, with clam-shell bucket operated by crane.

11 CAP FORMS and reinforcing are set on top of nearly completed caisson to form reinforced-concrete slab 6 ft. thick.



9 DIVER prepares to descend into caisson, now sunk to grade, in order to clean shoulder prior to placing concrete seal.

10 CONCRETE SEAL *(left)* at bottom of caisson sunk to required depth is poured by submarine bucket.



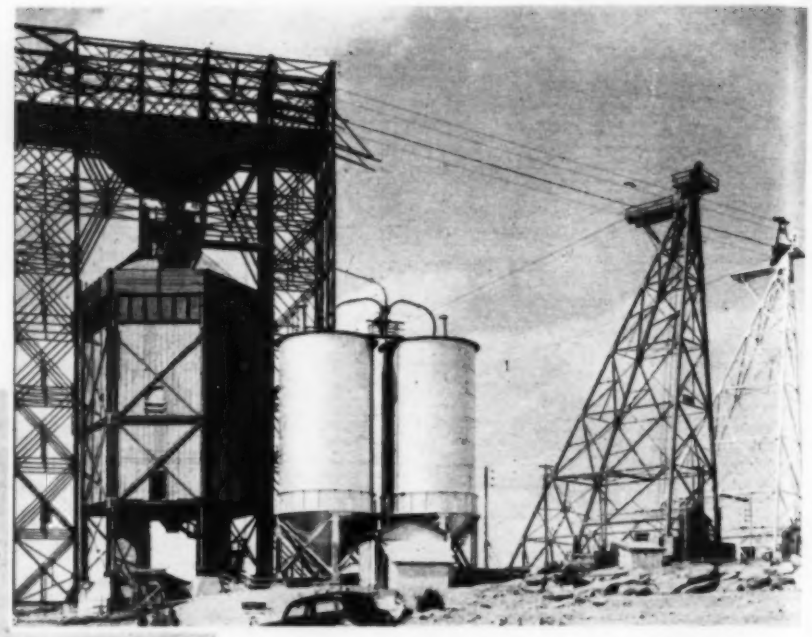
12 COMPLETED CAISSON, capped with 6-ft. concrete block, ready to support columns of power plant structure.

13 FOUR OF THE CAISSONS at Columbia power plant site, showing work finished and in several stages of completion.

How They Did It—

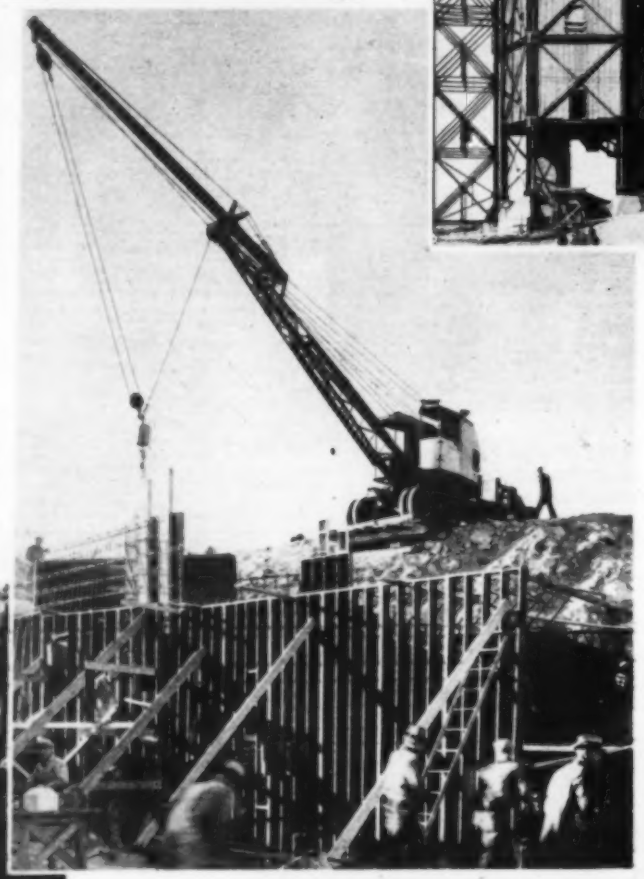
CONSTRUCTION DETAILS FOR

Superintendents and Foremen



CONCRETE BATCHING AND MIXING PLANT

at Conchas dam, New Mexico, being built by Bent Bros., Inc., and Griffith Co., of Los Angeles, Cal., under direction of Capt. Hans Kramer, U. S. District Engineer. Aggregates are delivered by aerial tramway to unloading terminal above mixers. In center are bins for handling bulk cement; at right are towers serving cableways commanding dam site. Concrete gravity dam, costing $4,588,000, will be 235 ft. high and 1,250 ft. long, with earth dikes on each side.

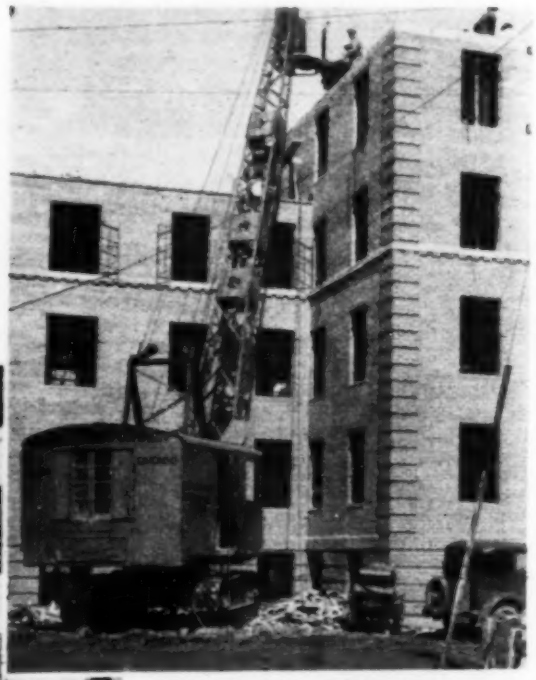


TIMBER EXTENSION

measuring 30 ft. in length *(right)* increases reach of standard boom on Lorain truck-crane used to handle concrete and forms on section of Colorado River aqueduct near Coachella tunnel, being built by Metropolitan Water District of Southern California.

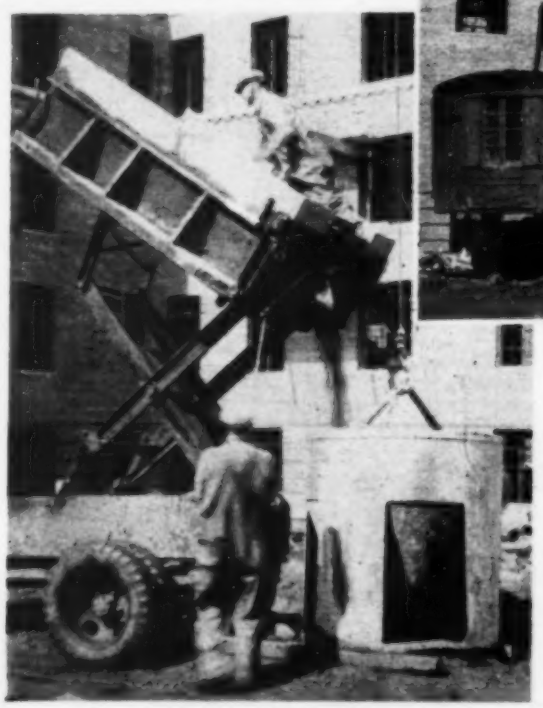
BLOWER DEVICE

for cleaning paving joints *(left)* prior to application of bituminous filler, consists of nozzle and hose utilizing exhaust from Ford motor truck. Rig was devised by Noonan Construction Co., of Pensacola, Fla.



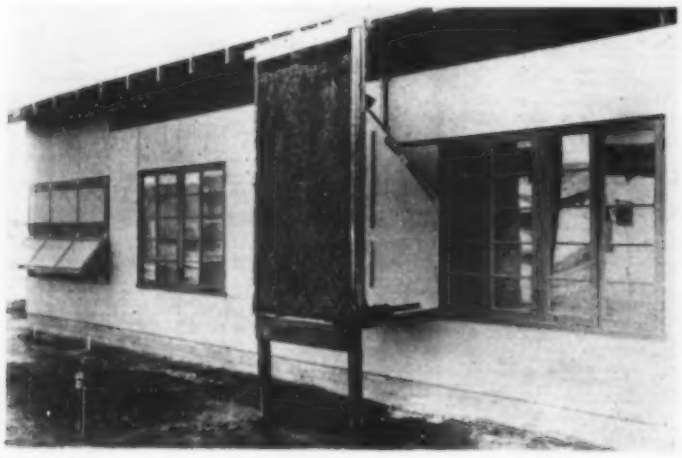
TRUCK TO BUCKET TO CRANE

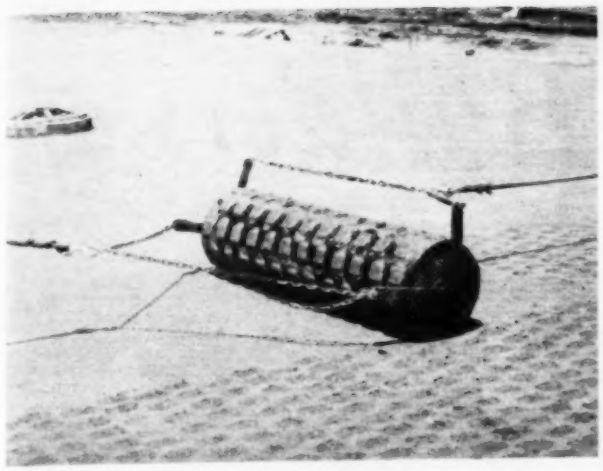
Concrete handling method *(above and at right)* employed by Henry Ericsson Co., contractor for superstructures of Julia C. Lathrop Homes, $5,942,000 mass housing project in Chicago, being built under supervision of Housing Division of PWA. Example of equipment teamwork in Chicago recalls famous baseball double-play combination of Tinker to Evers to Chance.



AIR COOLING

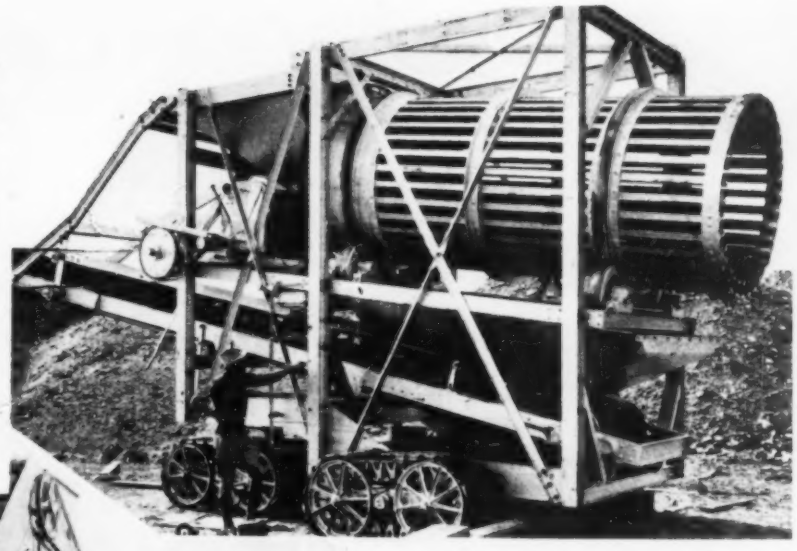
for U. S. Bureau of Reclamation camp houses at Imperial dam, *(left)* in Southern California, is accomplished by homemade device of excelsior mat held in wood, frame by chicken wire. Perforated tin trough sprinkles water across top of mat as electric fan draws air current through moist excelsior into living room. Device lowers room temperatures 10 to 15 deg. F. Water required, 25 to 100 gal. daily.





PAVING BOND

between 8-in. concrete base and 2-in. bituminous top surface *(left)* on approach to Outer Drive bridge, Chicago, is accomplished by knurled roller which forms depressions as it is drawn across fresh concrete base. Paving is being done for Chicago Park District, under subcontract with W. E. O'Neil Construction Co., by Arcole Asphalt Co. of Chicago, Ill.

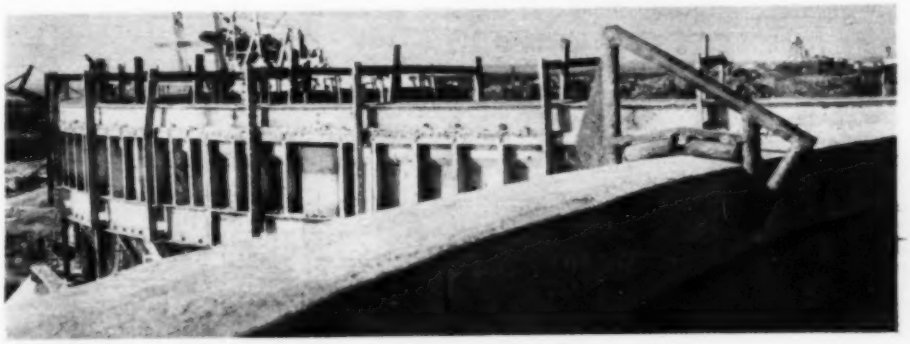


UTILITY GRADER

employing continuous line of digging buckets, *(right)* prepares subgrade for General Asphalt Paving Co.'s widening and resurfacing job north of Massilon, Ohio. Existing 17-ft. brick-paved width is being increased to 20 ft. Grader designed by A. W. French, of Chicago, cuts 7-in. depth to finished grade and exact width, casting 75 per cent of earth on shoulder next to widening strip and 25 per cent across brick pavement on opposite shoulder.

PORTABLE REVOLVING SCREEN

and conveyor, mounted on crawler traction, removes oversize material and loads embankment material going into construction of Caballo dam, being built by U. S. Bureau of Reclamation on Rio Grande in New Mexico.



WELDED ROLLER BRACKETS

traveling on coping of parapet wall on multiple 70-ft. arch section of Buchanan dam, being built by Lower Colorado River Authority near Burnet, Tex., support scaffold on which cement finishers work. In background are steel forms for parapet construction.

MAINTENANCE RACK

aids regular servicing of fleet of 46 International motor trucks operated by Hooper Construction Co., of Bunnell, Fla., to move million cubic yards of earth and rock at site of new $30,000,000 tin-plate mill for Tennessee Coal, Iron & Railroad Co. at Birmingham, Ala. Each truck is pulled off its regular run every 60 to 70 hr. and driven on to elevated rack for oil change, lubrication and general mechanical check-up, requiring about 15 min. Contractor keeps on hand completely assembled transmission system and set of springs built up and ready for installation at moment's notice. For contractor C. J. Germack was head of truck maintenance operations.

"STRADDLE YELLOW LINE,"

says Texas Highway Department to drivers on Austin-San Antonio road, "and stay over it until it ends at crest of hill." This method of guiding motorists on upgrade is one of several experimental devices being tried under direction of Gibb Gilchrist, state highway engineer, to warn drivers against crossing center line of pavement as they approach crest and to permit normal driving latitude as soon as crest is reached.

WANTED—

Photos of Details

The Editor of CONSTRUCTION Methods and Equipment wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.

FOR SURVEYING IN MARSH

at site of Neches River bridge, Port Arthur, Tex., Texas Highway Department engineers, under direction of G. G. Wickline, install 8x8-in. timber posts 8 ft. deep in soft muck and brace them four ways with 2x4-in. sticks 8 ft. long drilled and bolted. Portable table to support short-legged instrument fits all hubs in survey, 364 in all, and clamps fast to post as indicated. Special 15-in. legs are fitted to instrument tripod to bring telescope down to eye level of man sunk to knees in marsh. Survey parties accomplish both level and transit work in this way with excellent results.—*Photo from* R. O. LYTTON, *assistant engineer, chief of surveys, Texas State Highway Department, Port Arthur, Tex.*

Builders of

ON $5,780,000 CONTRACT

for Marshall Ford dam, George Brown (left), vice-president, Brown & Root, Inc., Austin, Texas; A. J. McKenzie, president, McKenzie Construction Co., San Antonio, Texas, and Herman Brown, president, Brown & Root, Inc., combine forces to form Brown & Root, Inc., and McKenzie Construction Co., of Austin. Gravity dam 190 ft. high, containing 1,000,000 cu.yd. of concrete, is being constructed 18 mi. northwest of Austin under direction of U. S. Bureau of Reclamation for Lower Colorado River Authority, a Texas body, with funds provided through $20,000,000 loan and grant from PWA.

U. S. BUREAU OF RECLAMATION

directs construction of Marshall Ford dam for Lower Colorado River Authority through agency of M. J. Miller (left), field engineer; H. P. Bunger, construction engineer in charge of Colorado River project for Bureau of Reclamation; and C. P. Seger, resident engineer.

MARSHALL FORD DAM

is being constructed under active supervision of three representatives of Brown & Root, Inc., and McKenzie Construction Co.: (left to right) E. M. Whipple, superintendent; W. H. Prentice, manager; and R. M. Dunham, engineer.

FARTHER UPSTREAM,

about 50 mi. by road from Marshall Ford dam, construction operations on Buchanan and Roy B. Inks dams are directed for Lower Colorado River Authority by R. B. Alsop (left), superintendent, and Holton Cook, engineer. These men are in complete charge of force-account operations on Buchanan dam, and they maintain general supervision over contract work on Roy B. Inks dam.

Big Dams

On Colorado River of Texas

AT BUCHANAN DAM

construction operations of Lower Colorado River Authority are carried out under the direct supervision of James Patterson (left), assistant superintendent in charge of work on south side of river, and A. C. Cerney, assistant superintendent in charge on north side of river. These two men report directly to R. B. Alsop, superintendent.

AFTER GOOD LUNCH

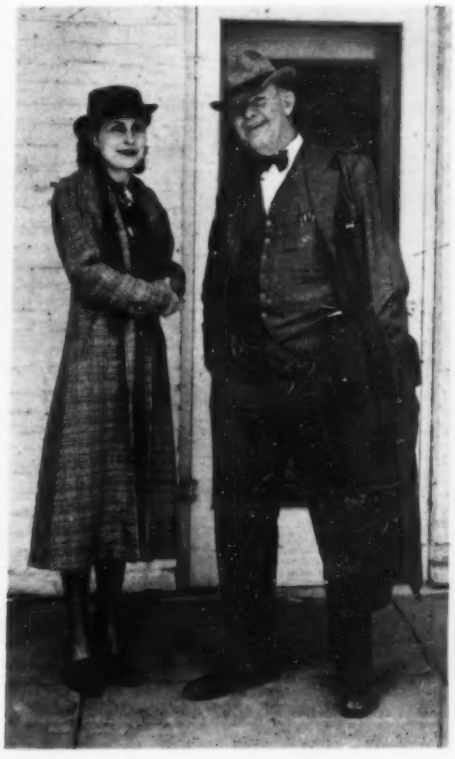
in contractor's mess hall at Roy B. Inks dam, four men assemble *(left)* in front of job office: (left to right) L. J. Haldiman, office manager, and B. (Woody) Williams, superintendent, Morrison-Knudsen Co., Inc.: A. J. Reinhard, director, and R. E. Rudolph, personnel officer, Lower Colorado River Authority.

LAW AND ORDER

at Buchanan dam are maintained by C. S. Shipp, superintendent of police, who here looms large to left of Holton Cook, engineer for Lower Colorado River Authority. Mr. Shipp's police authority is reinforced by his commission as one of Texas' famous Rangers.

ROY B. INKS DAM

is constructed under direction of A. G. Ranney (left), resident engineer, and B. (Woody) Williams, superintendent, Morrison-Knudsen Co., Inc., Boise, Idaho, contractor. Methods of construction on Roy B. Inks dam are described elsewhere in this issue.



AT OFFICE ENTRANCE

in Austin, Tex., Miss Mary Nell Spires, secretary to Herman Brown, of Brown & Root, Inc., stops to look at camera with R. M. Dunham, engineer for contractors on Marshall Ford dam.

ON THE "LONGEST ALL-MODERN

CONTRACTORS *Select*

An inviting 71-mile stretch of super-highway is nearing completion on U. S. 41 between Chicago and Milwaukee. With its four traffic lanes of concrete throughout and 61 miles of center parkway, this boon to heavy traffic has been called the "longest truly modern highway in the country." The project involved 30½ miles in Wisconsin with 1,040,000 yards of excavation .. 26.6 miles in Illinois (exclusive of Cook County) with 1,436,387 yards .. construction of two 20-foot pavement lanes, a parkway and 10-foot shoulders.

As on so many large construction jobs, Allis-Chalmers tractors predominated on the U. S. 41 project. Among the contractors who used A-C equipment are J. R. Griffith Co., Racine, Wis.; Burch Construction Co.,

This automatic traffic reporter — an invisible "electric eye" — counts each passing car, records the time, and compiles totals every hour. It is located on U. S. 41 in Milwaukee County, Wis

RN HIGHWAY"...

t LLIS-CHALMERS TRACTORS

Madison, Wis.; Bartel-Maurer, Milwaukee, Wis.; A. E. Bounsall, Kenosha, Wis. and Chicago Heights Coal Co., Chicago Heights, Ill. A-C Tractors were used on scrapers, on elevating graders, for bulldozing, and for blade grading. But no matter what the job, their higher working speeds, greater flexibility and freedom from dead weight showed up to advantage on the cost and time sheets.

Allis-Chalmers is proud to have contributed cost-cutting equipment for so worthy a project. It is the constant objective of this company to build equipment that the contractor will be proud to own ... that will speed up the tempo of his operation, do the job "Cheaper-per-yard" and increase his profits.

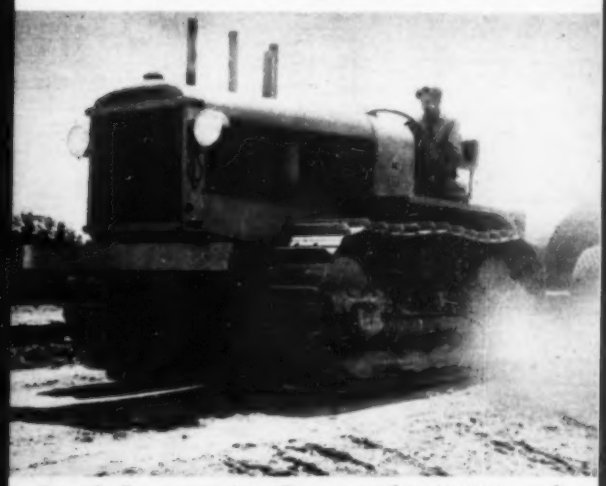
ALLIS-CHALMERS

TRACTOR DIVISION - MILWAUKEE, U. S. A.

ALLIS-CHALMERS OWNERS "REPEAT"

Bartel-Maurer, Milwaukee, is building the grade for 3½ miles of new 20-foot slab on U. S. 41 in Racine County, Wis. Shown here is their A-C Model "K" and bulldozer.

A. E. Bounsall has a paving contract in Kenosha County, Wis. This Model "K", one of their A-C units, is finishing the shoulder with a layer of fine sand and gravel.



Burch Construction Co. moved 183,000 yards of dirt on their 3½-mile stretch in Kenosha County, Wis. The fast-stepping Model "L" proved ideal on the elevating grader.

On the Illinois side of the line, Chicago Heights Coal Co. used Model "L" tractors to move 199,828 yards on a 4.12-mile contract.

Planning and Plant for

NINETEENTH OF A SERIES OF ARTICLES

HEAVY CONSTRUCTION

Principles and Practices of Job Layout and Selection and Use of Equipment

By

ADOLPH J. ACKERMAN and CHARLES H. LOCHER

Construction Plant Engineer — TENNESSEE-VALLEY AUTHORITY, KNOXVILLE, TENN. — *Construction Consultant*

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Other Special Foundations and Pier Caissons

PRACTICALLY ALL of the principles which apply to large pier caissons find application at some time or other in the construction of a dam or related works. A brief description of some of the more notable caisson jobs, therefore, is included here.

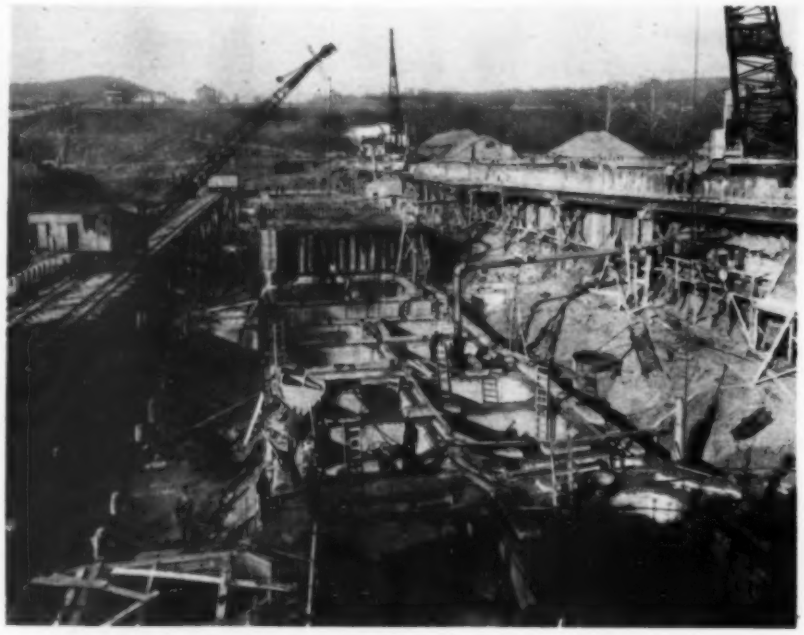
An unusual type of dam construction was employed on the Montgomery Island dam in Pennsylvania, where the overburden was such as to call for construction of the lower part of the dam in the form of cellular boxes which were cast directly on the sand formation and provided with wells through which the sand could be excavated. This caused the cells to sink and allowed additional lifts of concrete to be placed on top until the base in this manner reached the rock bottom, after which the spillway section of the dam was added. This method of dam construction is probably suited only to certain conditions. On a larger scale project a greater opening up of cofferdam and excavation activities may be justified to a point where heavy production at high speed will produce sufficiently lower unit costs of excavation and concrete placement to offset the greater amount of other work necessary under such a method.

In the case of the Washington Bridge foundation the usual caisson methods were displaced by a cellular sheetpile cofferdam of exceptional depth and equipped with a system of internal timber framing to withstand the external water loads after the area was unwatered. This method is an adaptation of open cofferdam and caisson principles and is particularly suitable for exposing small areas where steel cells, stable by themselves, would prove too expensive.

OPEN FOUNDATION COFFERDAM used in place of caisson for George Washington bridge pier, New York.

Sand Island Pier Construction

The process employed at Montgomery Island dam is similar in principle to the one developed by N. F. Helmers, of Siems-Helmers, Inc., St. Paul, Minn., under which a special island of sand is constructed in a river to provide a stable footing through which a pier may be sunk to rock or other sound formation. This "sand island" method (patented) has been used recently on a number of large bridges, including the Suisan Bay bridge in California, the Mississippi River bridge at New Orleans, and a bridge on the Missouri River near St. Charles. On the Mississippi River bridge five piers were constructed on a foundation of a mixture of mud, soil, and clay in layers to unknown depth and very unstable and erodible at the surface. The pier foundations were carried to 188 ft. below average high water level.

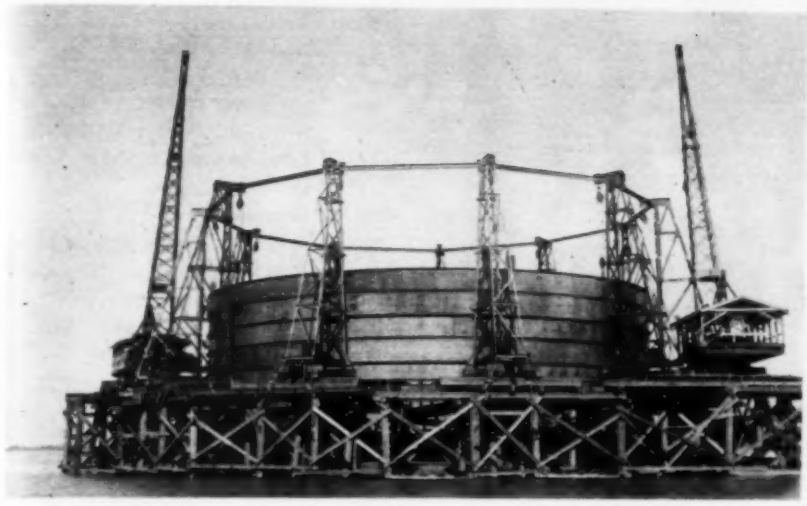


SECTIONAL TYPE of cellular base for Montgomery Island dam on Ohio River in Pennsylvania. These cells were sunk through heavy overburden to rock by excavating out through the openings.

As a preliminary step, woven willow mattresses were sunk at each of the pier sites in order to protect the area of the river bed against local scouring due to construction activities. A timber pile falsework, composed of 110 to 135 ft. long bents sunk to about 25 ft. penetration and with tops about 4 ft. above normal high water, was constructed with a circular working platform on top. Thereafter cylindrical steel shells were constructed in sections 10 ft. high. These shells were up to 120 ft. in diameter, assembled in the falsework, and were attached one on top of the other to a height of 30 ft. This assembly was then lowered 30 ft., and additional 30-ft. sections were added in similar steps, until the shell was seated firmly on the mattress and the top was a safe distance above water level. The assembled shells were from 70 to 100 ft. in height. The mattress was then cut out along the inside of the shell, and the shell was filled with sand to a point above water level.

The concrete pier caissons were 65x 102 ft. in area and were sunk inside the shells by dredging sand out through wells left in the caissons, and by building up the caisson walls as the sinking proceeded. The concrete caissons were eventually 135 ft. high and supported a 50-ft. high timber frame which served as a cofferdam for later unwatering and erection of the remaining portion of the concrete pier by open water methods. After a pier was completed, the remaining sand between the completed pier and the steel shell was dredged out and the shell was removed for re-use by detaching the lowest section accessible to a diver.

This method of caisson work reduces the danger of tipping and blowouts when working through unstable or soft material. Hydrostatic forces are balanced inside and out during practically all of the operations, and if any damage should occur before stability is obtained by filling the shell with sand, such damage occurs only on temporary construction and not on the main pier. As an example of progress, pier No. 2 on the Mississippi River bridge was



STEEL SHELL being lowered into place to provide sand island for construction of bridge pier on Mississippi River bridge at New Orleans.

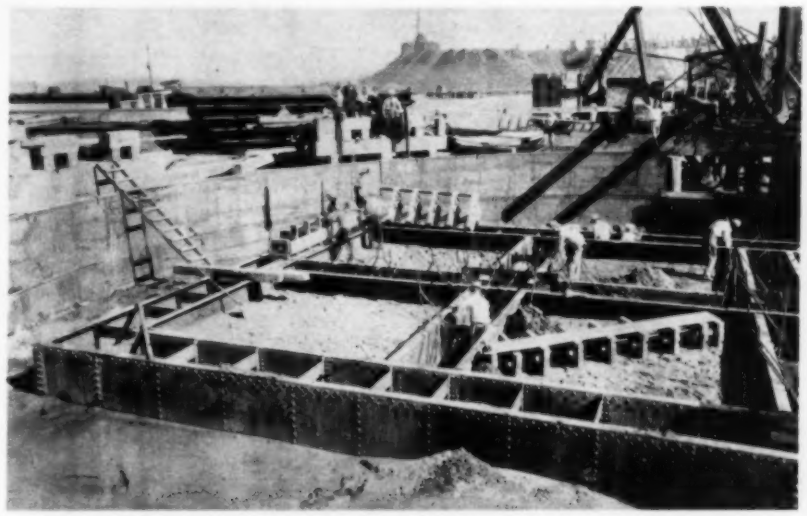
constructed in 135 days from the time falsework was started until the pier was completed above water level.

Pneumatic Caissons

Where a pier caisson is being lowered to rock by means of internal excavation and is penetrating an unstable or water-bearing material which tends to flow upward into the excavated space, air pressure is necessary to hold the material in place and to maintain a working chamber in which men can carry on the excavation. A simple pneumatic caisson consists of a cutting edge at the bottom of the side-walls and a roof about 6 to 7 ft. above this edge to develop a working chamber. All of this structure forms part of the ultimate pier, and concrete is added on top of the roof to overcome buoyancy and to furnish the necessary load to maintain the sinking process. The men inside the working chamber fill buckets with muck and excavated materials and these are carried out through so-called mud locks built into the roof, which are designed to permit disposal of the excavated material without loss of air pressure. Similarly, men may enter or leave the working chamber through a lock without loss of pressure inside. Reliability of a low pressure air supply to the working chamber is a prerequisite, and as a rule oil-driven engines are used, together with such electric-driven engines for high pressure tools and other purposes as will not handicap the operations or endanger the workmen if the power should go off.

In the case of air locks used to sink the caissons for the Pennsylvania Railroad bridge over the Passaic River in New Jersey, working pressures ranged from 9 to 27 lb. per square inch. Three caissons, two of them 36x98 ft. and one 24x87 ft., were sunk to a level of 69 ft. below sea level. The rate of sinking was 2 to 2½ ft. per day of 24 hr., 6 days per week, and the sinking for each of the three piers took 40, 45, and 50 days respectively.

The air lock caissons used on the Gulf Oil Building in Pittsburgh, which are here illustrated, were sunk through



SAND FILL for steel shell and cutting edge being erected on top as first step in lowering concrete pier through the sand.

70 ft. of mud and clay to a sound bearing.

Compressed Air Regulations

Construction hazards are greatly intensified in compressed air work in tunnels, pneumatic caissons and the like. The hazards do not merely include all of the possibilities of blow-outs, caisson tipping and similar working conditions, but also the exposure of the laborers to caisson disease. It is standard practice to admit laborers through compression chambers and release them from the caisson through decompression chambers, under medical supervision and in accordance with state regulations as to rates of compression and decompression. Decompression is usually limited to a rate of 3 lb. in 2 min. for pressures of 36 lb. or less, while 1 lb. per minute is the required rate for pressures in excess of 36 lb.

Compressed Air Regulations, New York State

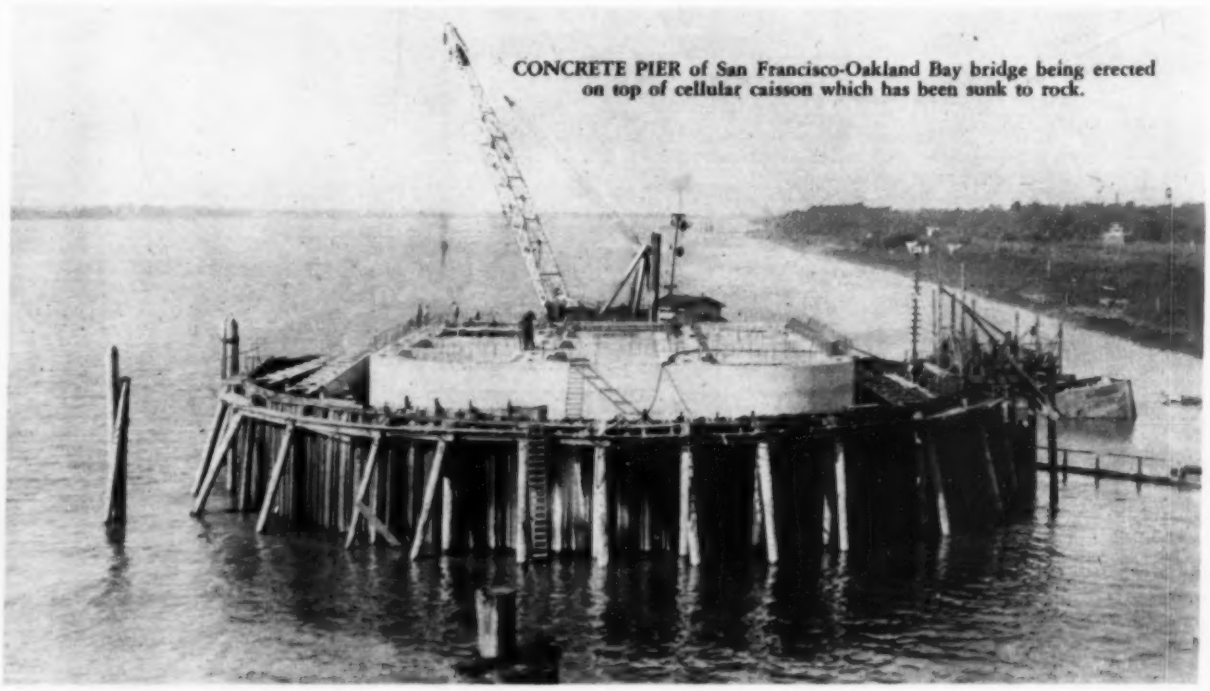
PRESSURES		HOURS OF WORK AND REST			
Pounds per Sq. In.		Working Hours Max. Total	Working Hours Max. 1st Shift	Min. Rest In Open Air Between Shifts	Working Hours Max. 2nd Shift
From	To				
Normal	18	8	4	½	4
18	26	6	3	1	3
26	33	4	2	2	2
33	38	3	1½	3	1½
38	43	2	1	4	1
43	48	1½	¾	5	¾
48	50	1	½	6	½

Eighteen pounds pressure is generally considered the critical pressure in compressed air work. Above 18 lb., special regulations for increased labor rates, shorter shift hours and more shift changes result in greatly increased cost, while below 18 lb. normal rates apply. In the pneumatic caisson construction of the Quabbin dam core walls in Massachusetts it proved economical to provide sufficient pump capacity to lower the ground water to keep working pressures below 18 lb. This was accomplished by pumping at 1,700 g.p.m. for five months preceding the main operations and at 3,500 g.p.m. during the work, these precautions having been prompted by the results obtained in sinking an experimental caisson about a year before the main job was undertaken.

The accompanying table gives the requirements of New York State for hours of labor in compressed air as related to an 8-hr. shift period.

San Francisco-Oakland Bridge Caissons

An outstanding piece of work with large caissons was recently completed on the San Francisco-Bay Bridge where four piers were sunk to depths ranging from 110 feet to 160-170 ft.; and three exceeded depths of 200 ft. up to 230 ft. A maximum depth of 150 ft. of mud and clay overburden was encountered and work was carried on



CONCRETE PIER of San Francisco-Oakland Bay bridge being erected on top of cellular caisson which has been sunk to rock.

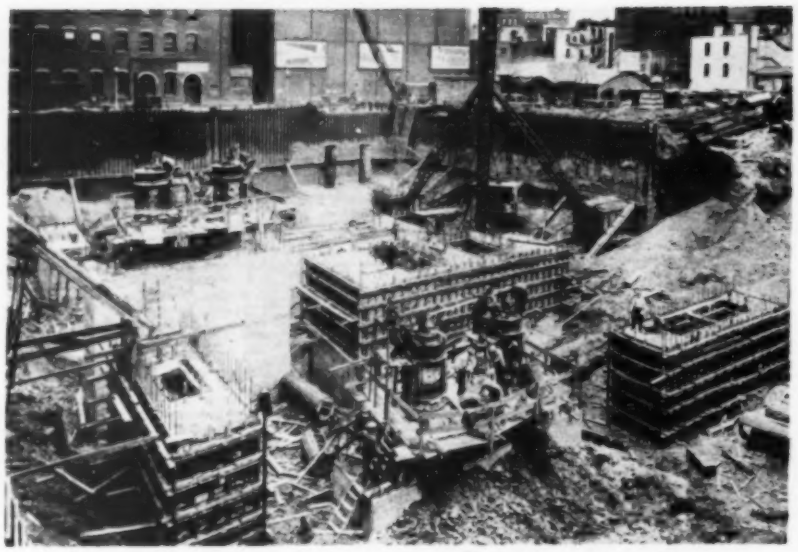
in water depths up to 105 ft. A special type of caisson was developed for this job. Two of the caissons were 74x127 ft. in plan, one of them 92x197 ft. in plan, and three others of somewhat smaller dimensions. Each caisson, in general, consisted of a group of 15-ft. diameter cylindrical steel cells spaced 17 ft. 6 in. in each direction, with the spaces between cells arranged for filling with concrete to the proper height as sinking progressed. The cells themselves were topped with removable steel domes which, when attached, allowed application of air pressure inside to regulate flotation while dredging was progressing through adjacent open cells. The cutting edge consisted of box girders with adapter sections connecting the square cells of the cutting edges with the cylinders. This system was built up into a single box-like structural steel unit at a shipyard and later launched and floated to position.

It was necessary to hold the caisson against currents running up to 10½ mi. per hour. The outside walls were carried to the top of the domes and concrete placed between the cells, or dredging wells, in order to sink the caisson. The tops of the cylinders and outside walls were extended from time to time as sinking progressed through the release of air. Most of the caissons required five to six months from the time they were delivered to the site until they were seated on the rock bottom. One 110-ft. caisson required only two months, whereas one 210-ft. caisson required eleven months.

The chief advantage of this type of caisson is that it is not normally necessary to work men at the bottom under air pressure, but in case of necessity it can be fitted with air locks within limiting depths of pneumatic work. The air pressure in the cells serves as a brake against sudden listing of the caisson, provides control in the cells to correct any list, and will hold the caisson level while sealing on sloping rocks.

The engineers in charge of this work have generously disclosed their experiences and point out that:

1. Where going through a non-homogeneous material the stability of the caisson is indeterminate, and the operations should be planned so as to minimize the attendant hazards.
2. It is necessary to keep the caisson weight low and the center of gravity as near the cutting edge as possible.
3. It is desirable to maintain symmetry at the cutting edge level. If this is not practicable, provisions should be made rapidly to restore symmetry if necessary.
4. Sudden movements of materials should be avoided. In soft materials dredging should be from the center gradually and evenly to relieve the cutting edge pressure, allowing the caisson to sink evenly.
5. Dredging should be by sinking opposite ends of the caisson in succession to reduce the probability of tipping sidewise.
6. Undercutting at the outside cutting edges should be kept to a minimum.
7. Attempts to speed up the operations are responsible for most caisson accidents.



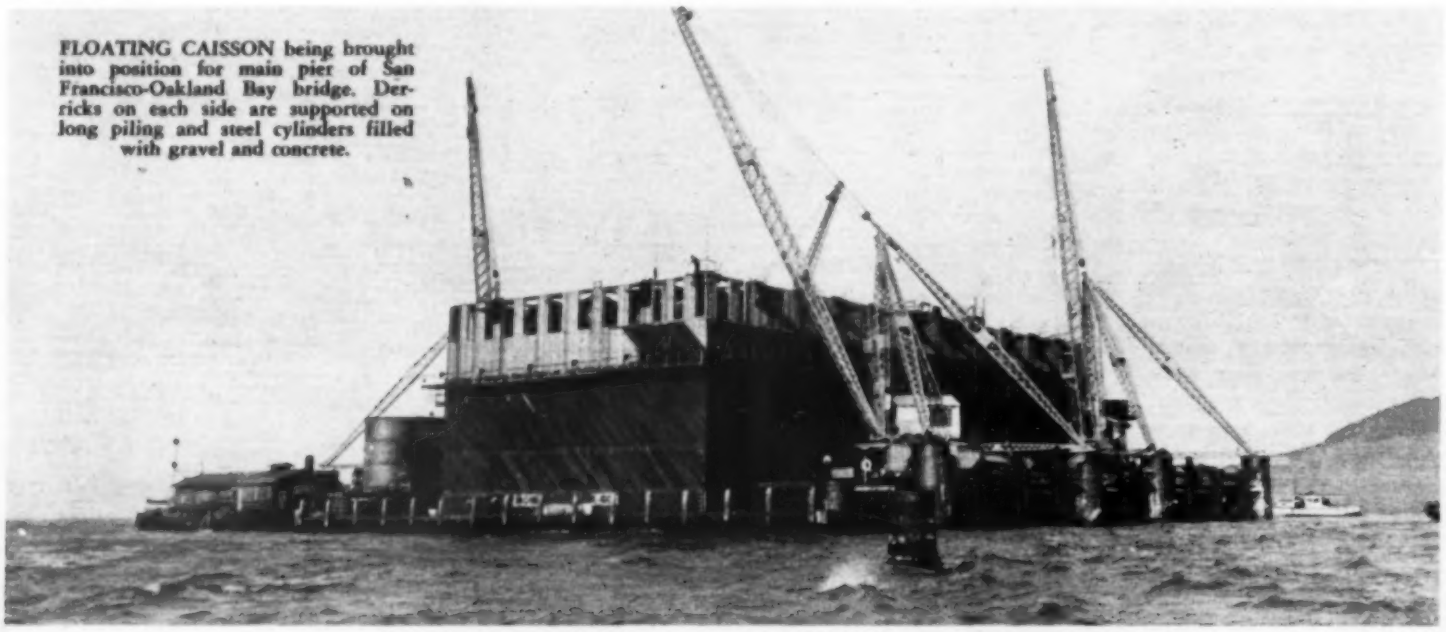
PNEUMATIC CAISSON being lowered for foundation of Gulf building in Pittsburgh. Note two mud locks in foreground in operation, and two more on caisson in background. Men working under compressed air are excavating mud and shale at base of caisson and loading into buckets which are raised through mud locks.

TOP OF CAISSON for San Francisco-Oakland Bay bridge, showing cylinders through which mud is being excavated while other cylinders are capped and carry compressed air for maintaining stability of caisson as it is sinking.

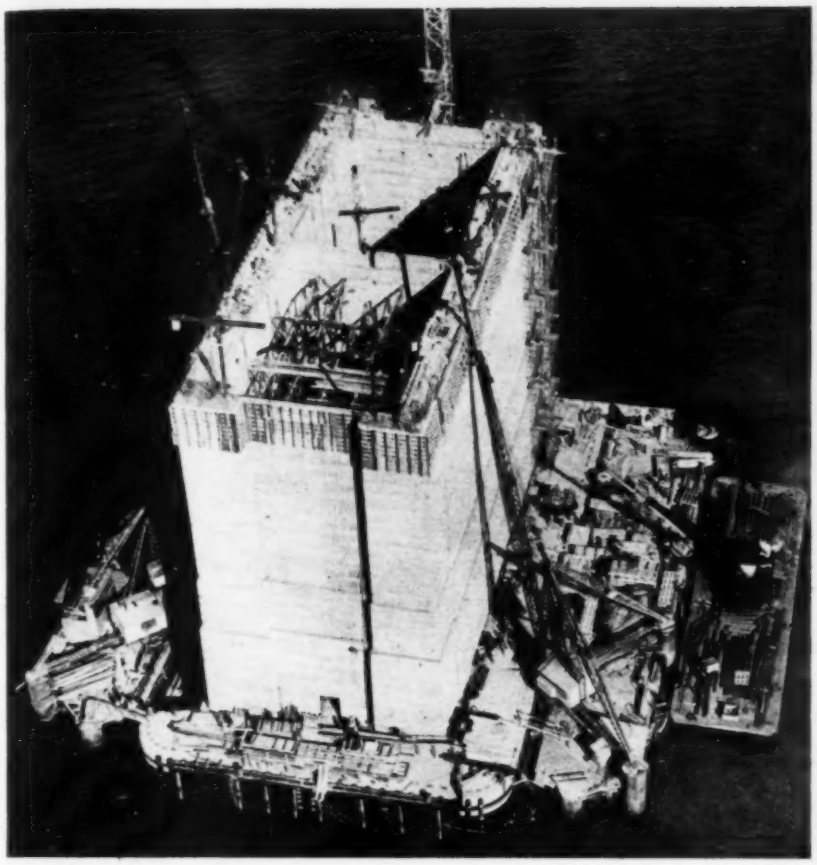
Danish Caisson for Bridge Piers

An open caisson of unique type 145 x73 ft. was used for the Little Belt bridge piers in Denmark. The caisson was partially built upside down for easy launching and was made up of about 4-ft.-diameter steel cylinders set side by side to form cellular side-walls extending 23 ft. below the concrete roof of the working chamber. The launched caisson weighed 7,000 tons. It was floated to shallow water, capsized, tipped upright, and part of the pier built up while the side-wall cylinders were extended upward above the water line. It was then placed in its position at the bridge site.

The caisson was sunk through the soft underwater formation by means of drills and water jets reaching through the cylinders in the side-walls, which loosened the material, after which it was carried to the surface by means of compressed air. As the caisson sank, the cylindrical side-walls were extended upward, and buoyancy was controlled by building up the pier structure within the caisson walls. After the caisson had reached the bottom it was opened, and excavation and concreting operations were executed in the dry and without the use of compressed air. A limiting condition in the work



FLOATING CAISSON being brought into position for main pier of San Francisco-Oakland Bay bridge. Derricks on each side are supported on long piling and steel cylinders filled with gravel and concrete.



CONCRETE PIER being lowered through sand island. This photo is a view of another pier where sheet piling was used instead of a steel cylinder to form the island.

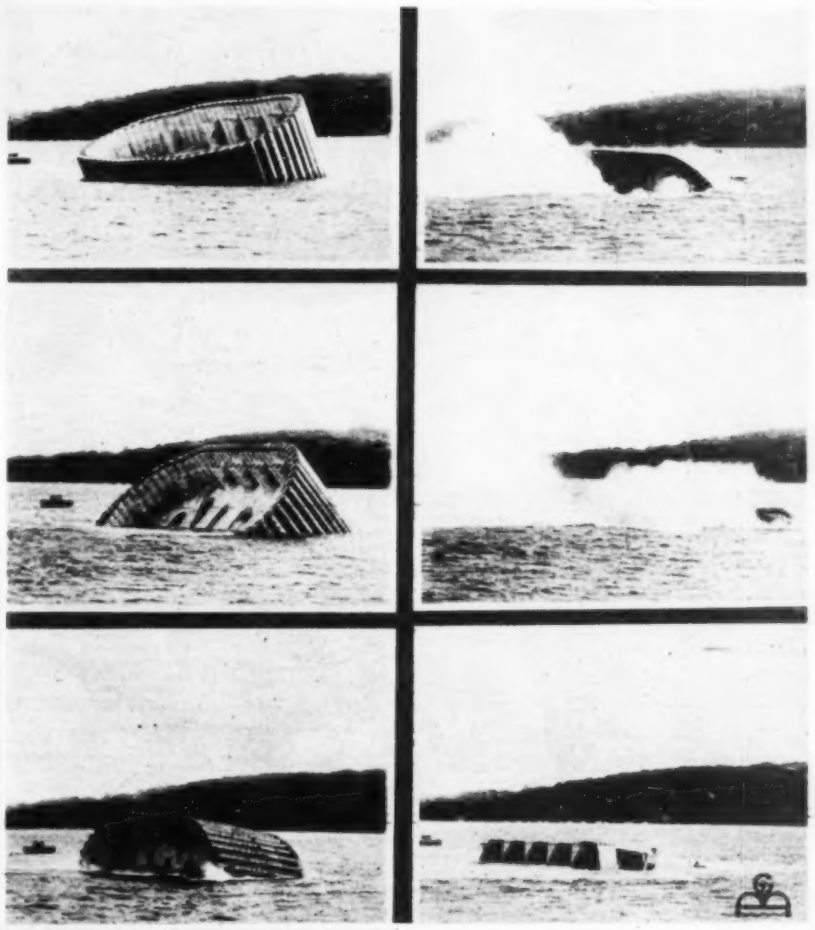
was the state regulation that the caissons be adaptable to compressed air work, but used only in cases of necessity. After the caisson was in place, the side wall cylinder extensions were removed, and the remainder of the pier was constructed above water. Building one pier required a total time of two years. The base of the foundation was 130 ft. below the water surface.

Underwater Work by Divers

The use of divers is becoming increasingly important because of the more difficult underwater work which is being attempted on modern work. Visual inspection of deep foundations for massive structures is imperative as a means of insuring the safety of the structure. Normally the maximum working depth is about 125 ft., although greater depths have been attained, notably on the foundation inspection for the San Francisco-Oakland Bay bridge, where a diver reached a maximum depth of 242 ft.

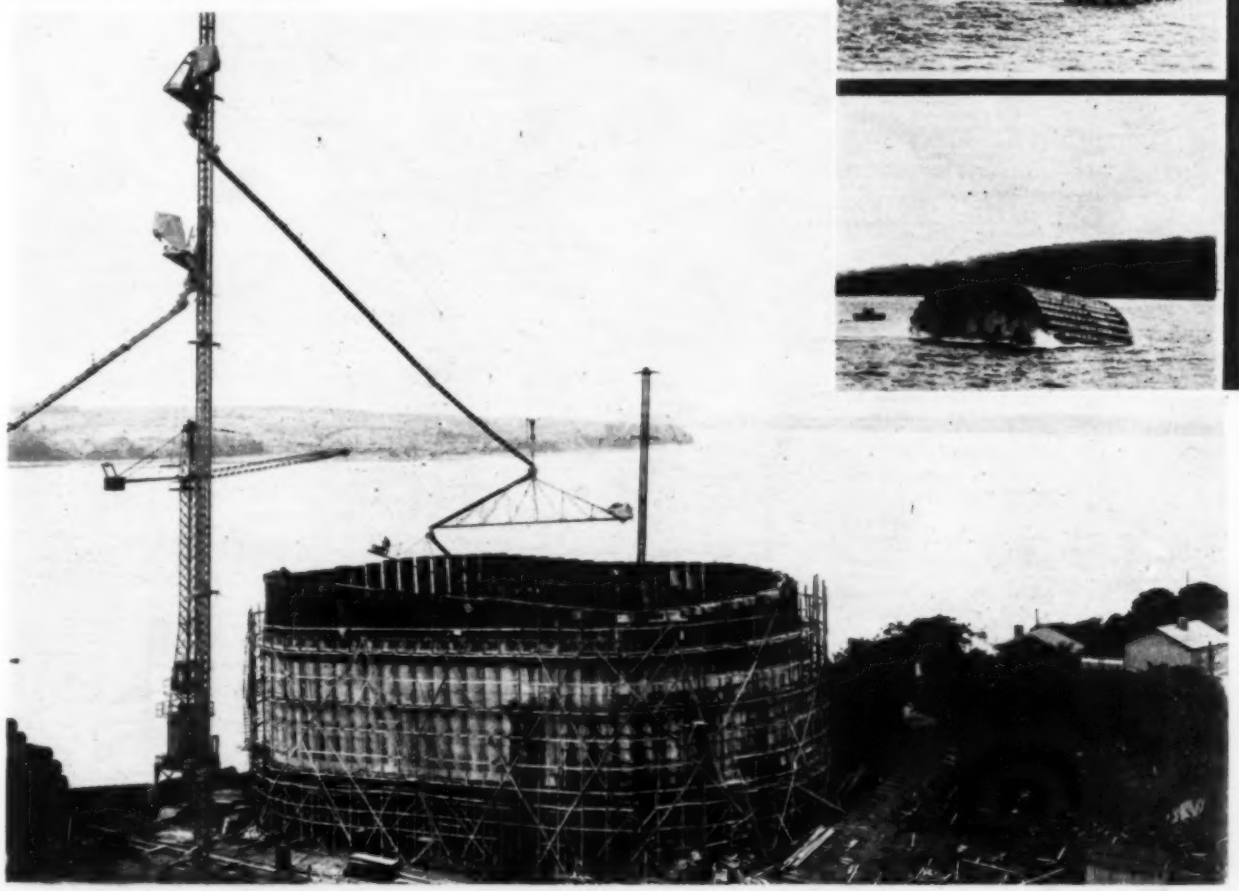
A large variety of work can be performed under water, including the cutting of steel by means of an oxy-electric torch, which has made possible fast and inexpensive cutting and removal of steel. The electric-arc torch is virtually a miniature electric furnace, and special precautions are necessary in handling it. This torch uses the metal to be cut as the ground electrode and the cutting action is produced when the carbon electrode at the end of the torch comes close to the metal and high-pressure oxygen is jetted from the torch. A diver who is expert in handling this torch can hold it at the proper distance about ¼ in. from the metal, gaging the distance by the sound developed by the arc.

The oxy-electric torch was used to cut the steel cofferdam piles on the George Washington bridge when it was found to be impractical to pull



PROGRESSIVE STAGES *(right)* in capsizing and righting floating caisson, launched upside down, for piers of Belt bridge in Denmark, built by Grün & Bilfinger of Mannheim, Germany.

FLOATING CAISSON *(below)* of special type being constructed upside down on land preparatory to launching and capsizing for Danish bridge piers.



them, due to deformation caused by driving and by the action of the currents. It was also used recently on the Marine Parkway bridge in New York where 2,118 piles were cut off 30 ft. below the water surface in 40 working days. An average of 60 sheet-piles were cut per day of one shift, and the actual cutting time was about three hours net per day, making the rate of cutting 20 sheet-piles per hour.

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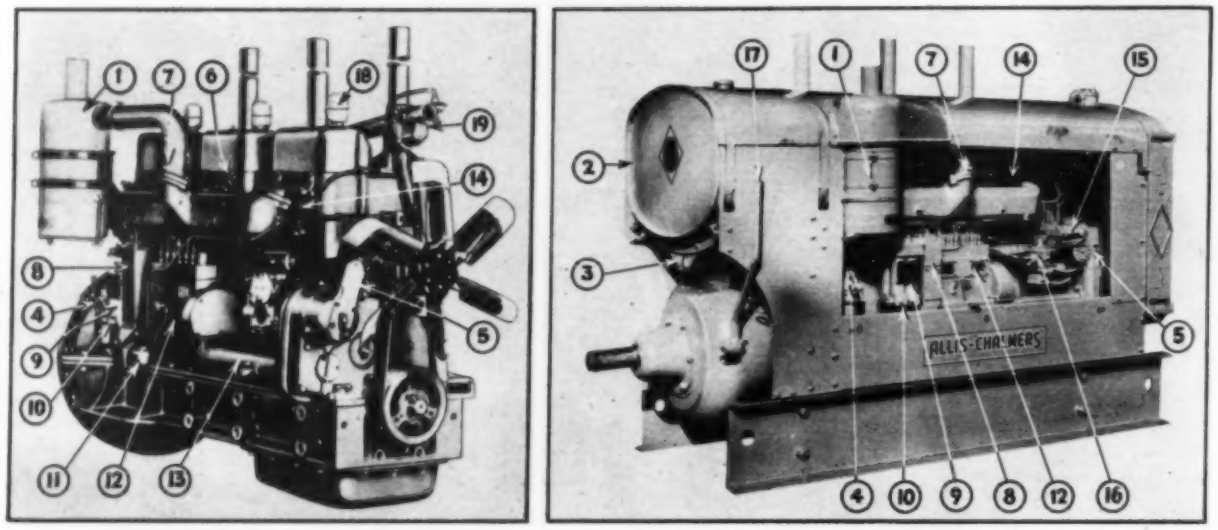
NEXT MONTH — Chapter 20 of the series on "Heavy Construction," by A. J. Ackerman and C. H. Locher, to appear in the August issue, will discuss "Concrete Aggregates, Screening, Crushing and Storing."

Operation and Maintenance of
Electrical Ignition Oil Engines
on Construction Work

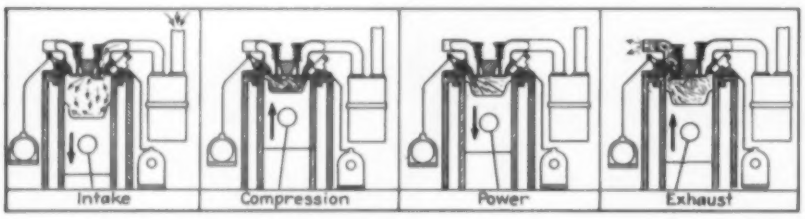
By P. G. KOLLBERG

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

LOW-COMPRESSION OIL ENGINES, utilizing fuel injection and electrical ignition, have reached a stage of mechanical development which assures efficient and economical service on construction work. Because combustion of atomized fuel oil in the cylinder is controlled by an electrical ignition system, engines of this type are legitimately entitled to the descriptive name of controlled ignition oil engines. As built today by Allis-Chalmers Manufacturing Co., the largest manufacturer of this type of power unit, controlled ignition oil engines are used in three crawler tractor models (one six-cylinder, 100-hp. unit and two four-cylinder units of 85 and 65 hp.), in two road maintainers (single-drive and tandem-drive), and in two primary power units, furnishing 85 and 56 brake hp. for continuous service.



SIX-CYLINDER SOLID-INJECTION OIL ENGINE of controlled ignition type, developing 85 brake hp. under continuous load, is shown unmounted *(at left)* and completely equipped as power unit *(at right)*. Numbers (most of which appear on both views; some on only one) indicate following parts: (1) air cleaner, (2) fuel tank, (3) ignition switch, (4) primer, (5) governor, (6) governor rod linkage, (7) throttle valve, (8) vacuum control, (9) fuel oil filter, (10) filter drain screws, (11) transfer pump, (12) fuel injection pump, (13) pump drive housing, (14) fuel injector, (15) ignition coil, (16) distributor, (17) clutch shifter, (18) crankcase breather, (19) thermostat.



These engines all are valve-in-head type and are designed with large main bearings, removable cylinder liners, inserted exhaust valve seats of tungsten steel, stellite-faced exhaust valves and full pressure lubrication. Proper air fuel ratio is maintained by accurate metering of both fuel and air. The engine governor operates a throttle valve located in the intake manifold, and the stroke of the fuel injection pump is varied in accordance with changes in the intake manifold vacuum. This automatic control maintains a balanced air-fuel ratio at all loads and speeds.

Controlled ignition oil engines operate satisfactorily on all commercial diesel fuel oils and domestic furnace heating oils manufactured in the United States. Because an oil engine consumes a smaller quantity of fuel than a gasoline engine developing the same power and doing the same work, and because the fuel oil used in the controlled ignition engine is much cheaper than the highly refined fuel required by the gasoline engine, the fuel cost for operating the oil engine ordinarily runs about 75 per cent less than for the gasoline unit.

Starting Operation

To achieve instant, easy starting, the controlled ignition oil engine is equipped with a small, hand-operated gasoline primer which injects gasoline directly into the intake manifold when the engine is being started. The gasoline mixes with air being drawn into the combustion chamber, where the mixture is compressed by the upward stroke of the piston. Into the volatile mixture of gasoline and air, fuel oil is injected in the form of a fine mist. A high-tension spark producing an open flame is discharged at the proper moment and readily fires the mixture.

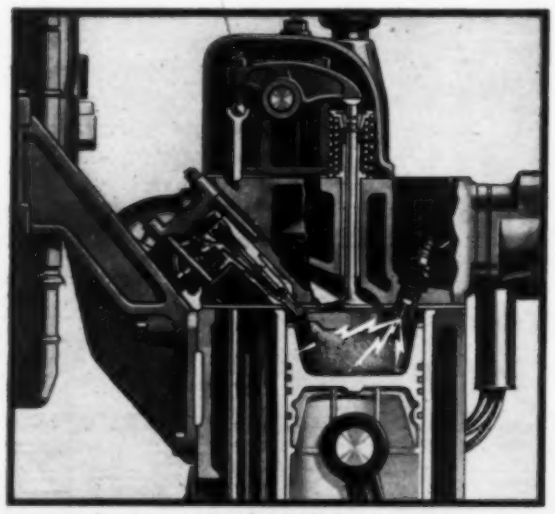
From this description of the starting operation it will be noted that: (1) The fuel injection pump begins to function immediately, and (2) with the assistance of the gasoline, the engine starts at once and operates in its normal manner. No warming up time is required, as there is no switching over from gasoline to fuel oil.

Engine Cycles

During the intake stroke a definite quantity of clean air is drawn into the combustion chamber, and this air is compressed to about 165 lb. per square inch during the upward travel of the piston. When the piston reaches a point about 60 deg. below top-dead center the injector sprays into the combustion chamber a fine mist of fuel oil, which mixes thoroughly with the air. As the piston advances to a point 12 deg. before top dead center, a high-tension electrical discharge (in the form of a flame) ignites the mixture, producing complete combustion of the fuel and creating a volume of high-pressure gas which forces the piston downward, making the power stroke. A uniform mixture in the cylinder and a hot spark combine to produce a smooth power stroke. On its return stroke (the exhaust stroke) the piston expels all burnt gas from the chamber. Low compression, thorough mixing and orderly combustion result in smooth engine operation.

Fuel Feed System

Fuel oil flows from a supply tank to a diaphragm-type fuel transfer pump, which discharges the oil to the filters at a pressure of about 8 lb. per square inch. From the filters, the fuel flows in-



ELECTRICAL FLAME DISCHARGE fires atomized fuel oil at beginning of power stroke.

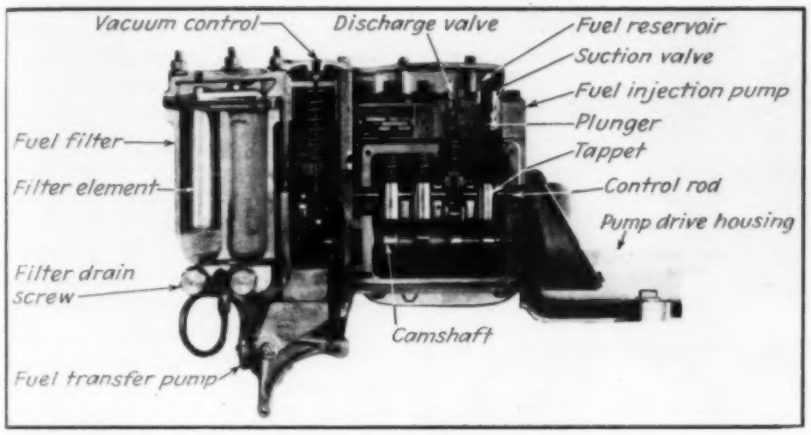
to a chamber at the top of the unit, and thence through a drilled passage to a fuel reservoir located at the top of the injection pump, directly above the suction valves of the pump.

At the proper time the suction valves open, admitting fuel to the plunger chambers. In these chambers the fuel is compressed to high pressure and is forced through a drilled passage to the discharge valves of the pump. Increased fuel pressure raises the discharge valves and allows the fuel to flow through injector lines leading to fuel injectors located in the cylinder heads. At a pressure of 1,400 lb. per square inch, the needle valve of the injector is raised, and fuel flows to the multi-holed injector tip, where the fuel is minutely atomized and discharged in the combustion chamber in the form of a mist.

screws are machined flat to provide greater working surface.

Vacuum Control Assembly

The pump control rod is connected to a simple vacuum control piston, the position of which varies with the change in manifold vacuum. Under full-load conditions, when the throttle valve is wide open and a maximum amount of air is being drawn into the engine, there is only a slight vacuum in the intake manifold, and the vacuum control piston assumes a position permitting the injection pump to deliver its maximum output. As the engine load decreases, the throttle valve closes and reduces the amount of air drawn into the engine. This reduction creates a higher vacuum in the intake manifold and draws the vacuum control piston downward against calibrated



FUEL FEED SYSTEM comprises (1) transfer pump delivering to filters of coiled bronze ribbon and (2) injection pump which takes filtered fuel and forces it through discharge valves and feed lines to injectors mounted in cylinder heads. Vacuum control piston connected to pump control rod automatically adjusts pump output in proportion to engine load.

Fuel Filter

A new type fuel filter used in the oil engine consists of two separate filter elements that are made up of continuous coils of bronze ribbon having 0.001 in. clearance between successive turns. The filter elements can be cleaned without shutting down the engine by means of filter drain screws which make it possible to back-wash and clean one element at a time by reversing the flow of fuel, while the other element supplies fuel in the normal way to the injection pump.

Fuel Injection Pump

Embodied in a fuel injection pump of plain design and construction is an individual pump unit for each engine cylinder. Each unit consists of a suction valve, plunger and barrel assembly, discharge valve and tappet assembly. The camshaft of the pump contacts the tappets, which in turn actuate the plungers. The length of stroke of the plungers is determined by the position of a fuel control rod which extends through all of the tappets. Those portions of the control rod which contact the lower edge of the tappet adjusting springs, turning the pump control rod in a direction which decreases pump output.

All parts of the injection pump are readily accessible and can be serviced in the field. The injection pump, vacuum control assembly, fuel transfer pump and fuel oil filter are assembled as one unit, eliminating outside fuel lines.

Fuel Injector

The fuel injectors are mounted in the cylinder heads and are held in place by brackets bolted to the heads. Fuel, flowing through small passages to the base of the needle valve, raises the needle valve at a pressure of 1,400 lb. per square inch, and discharges through the multi-holed injector tip in the form of a vapor into the combustion chamber. The end of the injector tip is the only part of the injector assembly that is exposed to the heat of the combustion chamber. All working parts are placed away from the high temperatures.

Ignition System

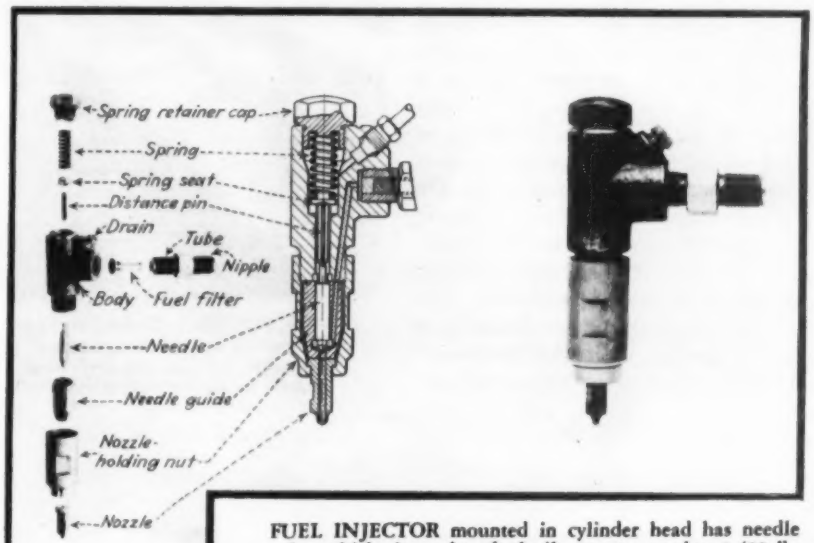
A storage battery ignition system (designed to produce an open flame) consists of a distributor having two sets of breaker points, a high-tension coil, a resistance unit, and condensers. All parts are accessible and can be readily serviced.

Engine Features

A strong, one-piece cast block keeps all engine parts in alignment and provides a rigid mounting for the transmission case which is attached to it. The cylinder heads, each covering two cylinders, provide water passages around the valves, and the removable cylinder liners permit water to circulate completely around each cylinder. All vital moving parts of the engine are lubricated by a full-pressure system. The oil pump is of the double gear type, providing a scavenging unit, which delivers oil from the rear end of the crank case to the oil sump, assuring a constant supply of oil regardless of the angle at which the engine is operated.

Training an Operator

Any man capable of driving a motor truck or automobile can operate an oil engine unit successfully, although he cannot get the best results out of a tractor or other unit equipped with this type of engine until he has had sufficient experience, which may range from two weeks to two months. Because of the automatic controls and adjustments with which the engine is equipped, no special training is needed to start and run the power unit. Calibration and replacement of parts in the fuel pump and the injection system can be made by any good mechanic.



FUEL INJECTOR mounted in cylinder head has needle valve which rises when fuel oil pressure reaches 1,400 lb. per square inch, permitting fuel to be discharged through multi-holed injector tip into engine cylinder.

Fuel Oil

Clean fuel oil is of paramount importance to avoid wear of the closely fitted parts comprising the injection system. Wear caused by solid abrasive matter in the fuel is practically the only cause for replacement of this equipment. By purchasing fuel oil of assured cleanliness and by handling it with care from the source to the job storage tank and finally to the fuel tank of the engine, most of the trouble resulting from abrasive matter and other foreign material in the fuel oil can be eliminated. A storage tank of 500-gal. capacity, or larger, promotes cleanliness of the fuel oil by giving the foreign material a chance to precipitate. If the reserve tanks are sufficiently large to permit the fuel to stand for two days prior to using, most of the foreign material will settle out.

Lubricating Oil

Controlled ignition oil engines do not require special lubricating oils. No compounding of oil is necessary — regular lubricating oils of standard quality are used successfully and are recommended.

Parts Replacements

Parts of the injection pump and injector assemblies can be replaced readily by a mechanic, because all parts are accessible and interchangeable. Replacement of any part of the injection system does not disturb the calibration of the unit. If a complete motor overhaul is desired, a full set of injection and cylinder parts may be purchased from the manufacturer at a cost of approximately $40 per cylinder.

Service Recommendations

Controlled ignition oil engines usually start promptly and easily. If difficulty is encountered in starting or if the engine stalls at any time, the trouble may be attributed to one of the following causes:

1. *Dry fuel tank* — The operator should always maintain a good supply of fuel in the tank.

2. *Timing* — The distributor must be timed properly and all electrical connections kept in good condition. When cranking the engine by hand, it is important to make sure that the spark retard plunger, located on the top of the distributor, is in the lower slot. This adjustment facilitates starting. The fuel injection pump also must be timed properly.

3. *Clogged fuel filter* — It is characteristic of certain fuel oils that when

operating at temperatures near the pour point of the fuel, wax may settle out of solution and collect on the surface of the filter element. Unless the wax is removed, it may build up and reduce the flow of fuel to less than that required by the engine. If this condition occurs, the elements should be removed and thoroughly cleaned.

Other possible causes of imperfect engine performance are the same as those found in a gasoline engine.

Large-capacity, highly efficient, oil wash-type air cleaners are standard equipment on controlled ignition oil engines, permitting continuous operation under extremely dusty conditions. The air cleaner, together with other seals provided, protects all parts of the engine against entrance of dust or dirt.

Operating Cost

In designing the controlled ignition oil engine it was the aim of the manufacturer to build an engine of plain and sturdy construction that would be as dependable and as economical in maintenance as the gasoline engine and as efficient as any other type of internal combustion engine of like size and power. With proper attention to lubricating and filtering, the engine needs no overhauling for long periods of time. Use of low compression reduces wear and permits lubrication with regular oils. Field records of operating cost for tractors driven by four-cylinder 65-hp. controlled ignition oil engines show an average fuel cost of $15 to $20 per 1,000 hr. of operation.

380 Barrels Support Floating Timber Bridge

PERPETUATING an historical curiosity of great interest to summer visitors and tourists, the town of Brookfield, Vt., with the aid of state funds and with the cooperation of the State Highway Department, which supplied the engineering design and supervision, last year built the latest of its floating bridges across Colt's Pond, this most recent structure being probably the fifth or sixth in a succession dating back to 1812. Absence of strong winds and strong currents in the sheltered pond, coupled with an almost constant water level, simplifies the problem of mooring a floating bridge and maintaining shore connections. Timber ramps 30-ft. long, forming the two ends of the bridge, rest upon a floating section which has a total length of almost 300 ft. and a roadway length of 260 ft. between pinned expansion joints connecting the flooring of the ramps and the float. The floating section is anchored at both ends by mooring chains to concrete deadmen in the pond, and the ramps are tied by chains at their upper ends to buried concrete blocks. A timber deck 20½ ft. wide carries a 12-ft. roadway and two 3-ft. sidewalks.

Load-carrying buoyancy is provided for the floating section by 380 watertight barrels arranged in five longitudinal bays, as indicated by an accompanying photograph. Transverse 12x12-in. timber beams and six longitudinal lines of stringers (four inner lines of 12x12-in. timbers and two outer lines of 6x12-in. timbers) comprise the framework of the floating section, forming pockets in which groups of barrels are confined. The barrels are not attached to any part of the structure but are held down by 5/16-in. galvanized iron chains anchored to 1-in. round galvanized rods. For the new bridge, the State Highway Department ordered 302 50-gal. barrels constructed of ⅜-in. red oak staves and heads with galvanized hoops. In the center bay, the builders placed 68 barrels salvaged from the old bridge.

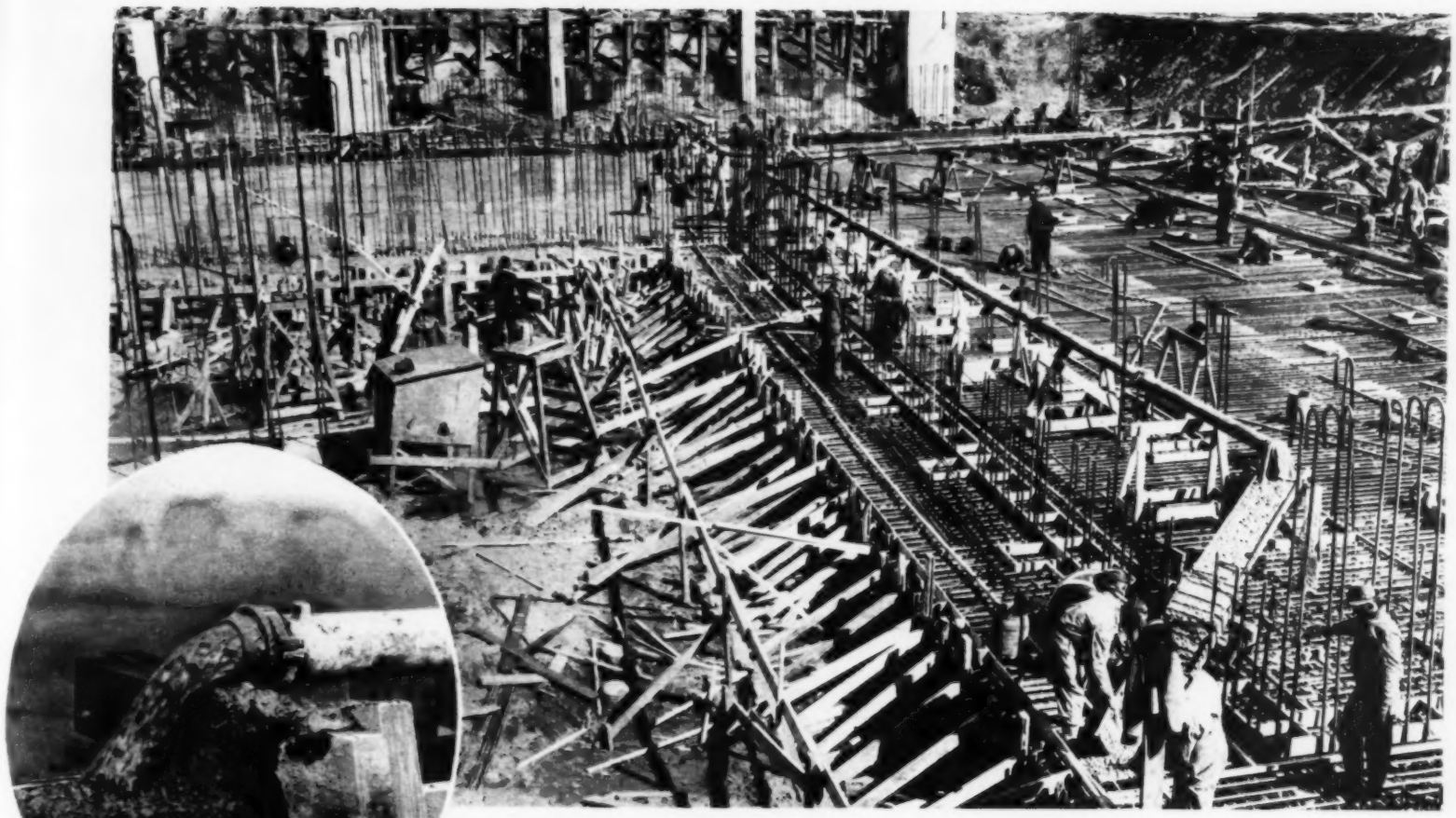
IN POCKETS formed by transverse timber beams (spaced 10 ft. c. to c.) and by longitudinal stringers, watertight oak barrels exert upward pressure against cross chains anchored to 1-in. round rods. Bolts for timber curb may be seen protruding through 4-in. timber deck.

A small crew of workmen fabricated the bolted timber framework of the floating section on the shore near the bridge site, pushing the frame into the water as the work progressed and placing the barrels under the galvanized anchor chains in the floating pockets. After the entire frame had been assembled, it was floated into place. An average of about nine men worked for 10 weeks to assemble and complete the entire bridge, including the ramps. The deck consists of 4x4-in. creosoted timbers laid with ¼-in. open joints.

Total cost of the completed structure, including engineering, was $12,286. All timber in the bridge, except the barrels, was given a 10-lb. creosote treatment, and all hardware was galvanized. Barrels were hot-dipped in tar in the field. The expected life of the bridge is about 45 years.

H. E. Sargent is commissioner of highways and chief engineer of the Vermont Department of Highways. Design and construction of the floating bridge were executed under the general direction of A. D. Bishop, bridge engineer. Clarence Tracy was in charge of construction for the state highway department.

VERMONT FLOATING BRIDGE carries 12-ft. roadway and two 3-ft. sidewalks providing direct access to one of state's moutain parks.



LAST POUR at press pit foundation. Twin pipe lines enter from right and separate at upper center to place concrete simultaneously at two points with aid of chutes at discharge ends of pipe lines.

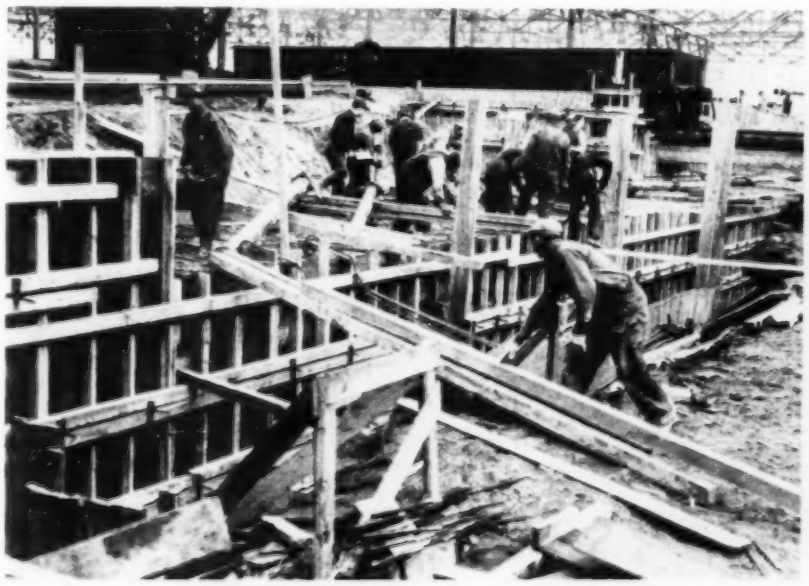
Pumped Concrete

Delivered by Twin Pipe Lines Over Area of 800,000 sq. ft. at Automobile Plant

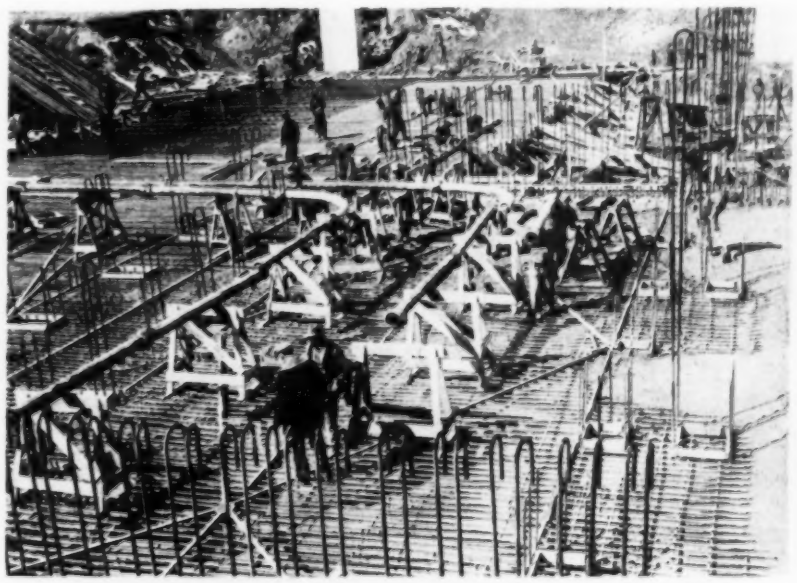
By EMORY D. ROBERTS

Professor of Civil Engineering, Marquette University, Milwaukee, Wis.

THROUGH TWIN PIPE LINES 7 in. in diameter 36,000 cu.yd. of concrete, mixed at a central plant, was delivered to place by pumping, over an area of 800,000 sq.ft. at the new plant for the Fisher Body Division of the General Motors Corp. in Grand Rapids, Mich. One of the projects in a large expansion and betterment program, this large modern plant for forming automobile bodies by stamping them out of sheet steel was constructed by the Jerome A. Utley Co., of Detroit. The high rate of construction progress on the job can be attributed to careful planning, adoption of proper labor-saving machinery, the employment of fewer men, but of the highest type, and to constant and careful attention to details throughout the construction period.



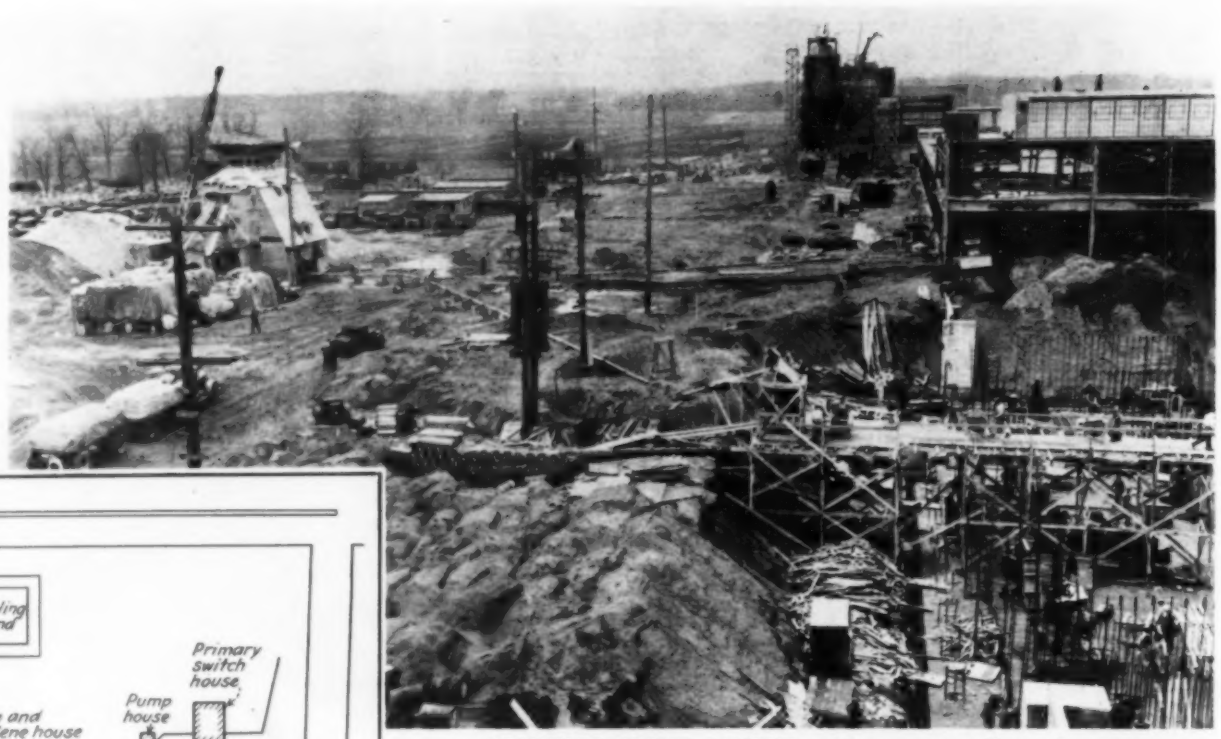
PLACEMENT of concrete for utility tunnel walls and slab by pipe line. Disconnected sections of pipe shown at left center.



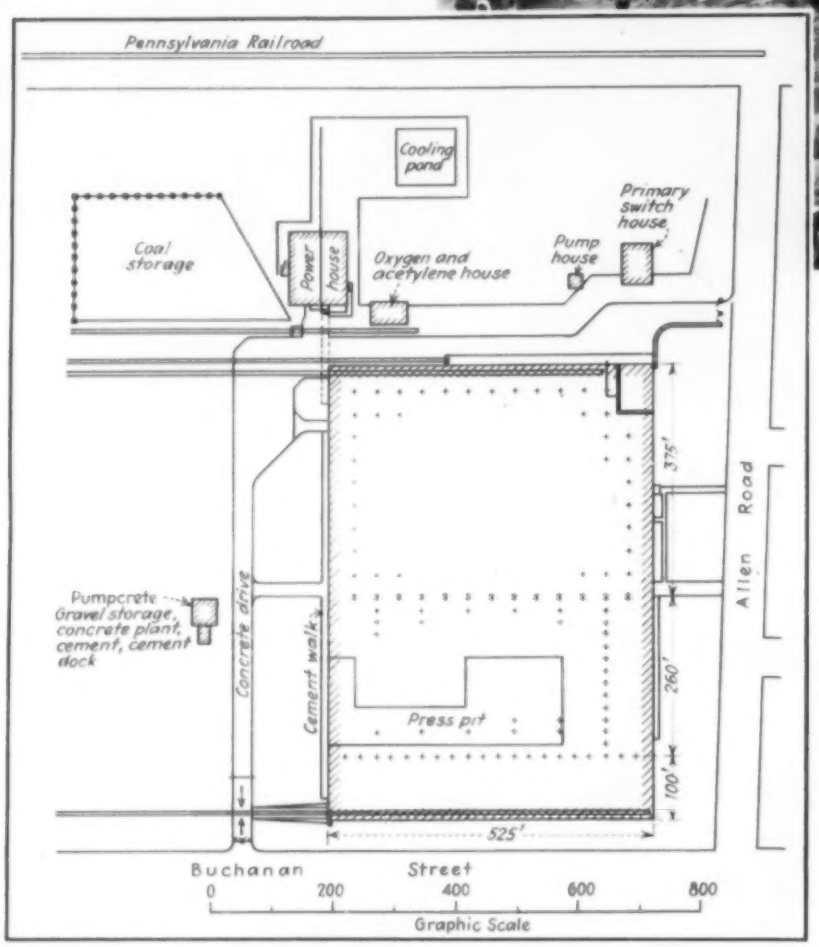
TWIN PIPE LINES, 7 in. in diameter, are assembled on movable horses, for delivery of pumped concrete.

The double pipe line feature leading from a twin Pumpcrete was installed to provide concrete at two points simultaneously throughout the construction area. The twin pipe lines also made possible the continuous pouring of the large monolithic press pit foundation, 176 ft. wide and 4 ft. thick, containing 6,540 cu.yd. The large mass of concrete was poured in 142 hr. elapsed time — an average of 44 cu.yd. per hour. At times the rate of placement reached 60 cu.yd. per hour.

Concrete Plant — The concrete plant was placed midway along one side of



CONCRETE PLANT LAYOUT, with aggregate piles and cement storage in upper left. Note pipe line running diagonally from plant for delivery of concrete to hopper for distribution by buggies.



PLANT LAYOUT, showing area of Fisher Body factory unit covered by pumping concrete through pipe lines from central mixing plant.

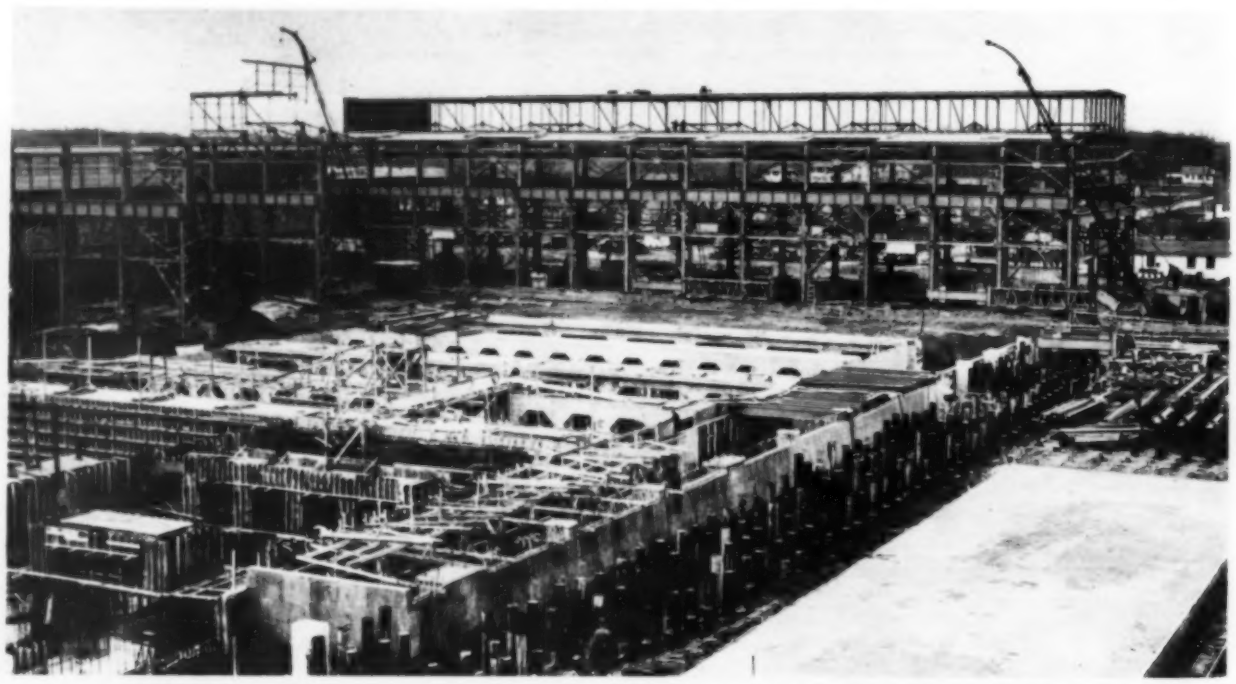
the building site, as shown on the accompanying plan. This location allowed stock-piling of aggregates without interference with any of the structures and gave ample room for cement storage and equipment for heating the aggregates and water during the cold weather of last February and March.

Sand and two sizes of gravel, No. 4 to ¾ in. and ¾ to 1½ in., were trucked from local deposits to the stock piles. It was reclaimed by a crane equipped with a clamshell bucket which placed the aggregates in the proper bins at the top of the mixing structure. An inclined conveyor brought cement from the storage platform to the weighing floor just below the aggregate bins. After the charge was assembled in the weighing hopper, it was discharged to one of the two 27-cu.ft. mixers located on the floor below. Both of the mixers discharged into a common chute leading to the remixing hopper of the Pumpcrete machine located below the mixers and on the ground floor.

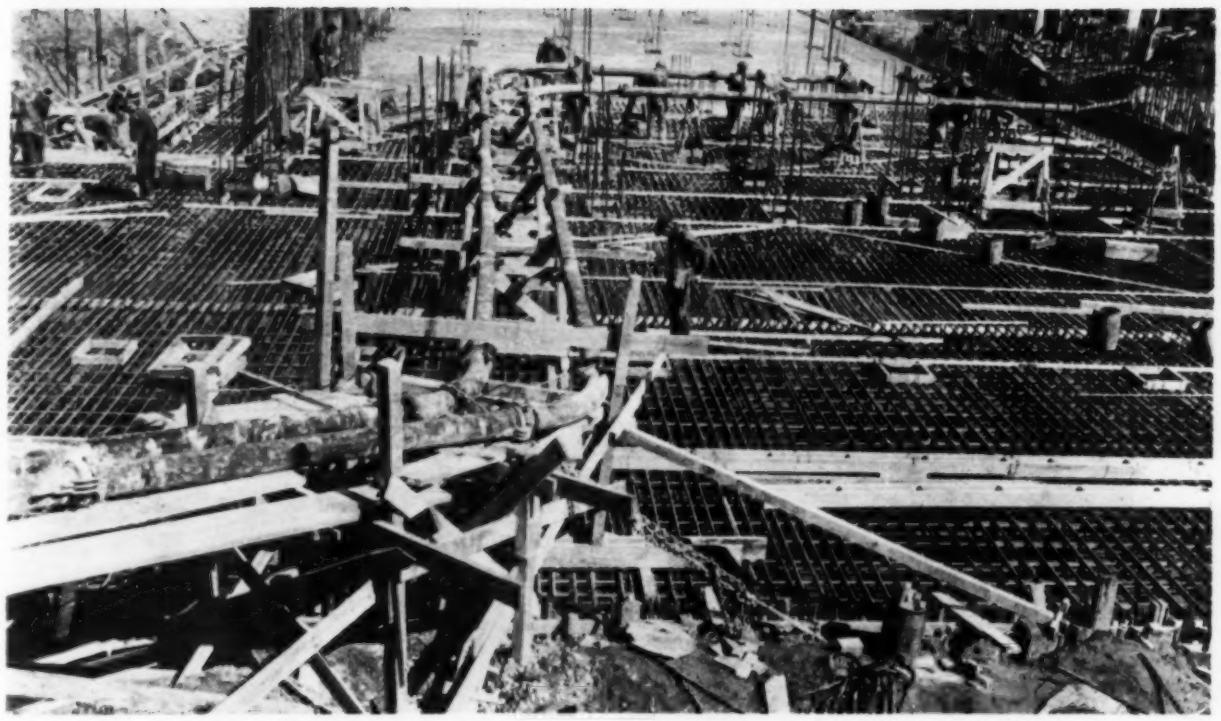
Revolving arms keep the concrete in the remixing hopper in continual motion while awaiting withdrawal from the hopper by the Pumpcrete. This machine has two cylinders, each 200 cm. in diameter, so arranged that one of the cylinders may pump while the other is idle and, when both cylinders are operating, one cylinder discharges concrete as the other draws in another charge from the remixing hopper.

How Concrete Is Pumped — The pumping operation is similar to the action of a piston pump when pumping liquids. On each suction stroke of a piston a charge of concrete is drawn from the remixing hopper through a specially designed valve into the cylinder. On the forward stroke of the piston the intake valve is closed and the discharge valve opened, allowing the piston to force the charge of concrete into the pipe line and, at the same time, force forward the charge of concrete already in the line, a distance equal to the length of the stroke of the piston.

In the normal operation of a double Pumpcrete, a Y-connection, called a Siamese, brings the concrete, forced



PRESS PIT concreting in progress, with craneways in background. Concrete hopper receiving pipe line discharge is shown in left center of photograph.



PRESS PIT FOUNDATION, 4 ft. thick and 176 ft. wide, was concreted as monolith by continuous pumping of 6,540 cu.yd. of concrete.

into the respective pipe lines by the pistons, into a common pipe line for transportation to the forms. On this project, however, individual pipe lines carried the concrete directly from each cylinder to the point of placement — sometimes at opposite parts of the site and at other times to the same point, as in the case of the press pit shown in the illustrations. An extra supply of pipe allowed the installation of trunk lines so that the supply of concrete could be switched from one point to another, as desired.

Before starting to pump concrete through the pipe line a dumbbell shaped contrivance called a "go-devil" is placed in the pipe line. The first batch of concrete (grout) is discharged into the remixing hopper and pumping started. The go-devil is forced through the line ahead of the concrete and keeps the concrete from separating. The batch of grout lubricates the pipe line so that the regular concrete passes through easily.

When nearing the end of the pour an estimate is made of the concrete in the pipe line and in the remixing hopper so that the mixers can be stopped at the proper time. When the last concrete is out of the remixing hopper, pumping is shut down momentarily to convert the concrete pump into a water pump. The go-devil is inserted in the line by breaking the line momentarily. Operating as a water pump, the Pumpcrete forces concrete out of the line ahead of the go-devil and washes out the pipe line at the same time. By tapping on the pipe line, the approach of the go-devil to the end of the line is noted so that pumping can be stopped before the water in the line reaches the concrete just placed.

Design of Concrete — At the start of the project the engineers of the Peerless Portland Cement Corp., which had the contract to furnish the cement, decided to furnish a scientifically designed concrete mix that would place easily and give the required strength. They recognized the many advantages of the central mixing plant, with the concentration of adequate supplies of aggregates, the better than average engineering, the installation of weighing and other devices for rigid control of the quantities of aggregates going into the mix, and the reduction of all variables to a minimum which would result in a uniform concrete. They also recognized the fact that the remixing hopper would add to the mixing time given the concrete by the mixers, thereby increasing the workability and strength of the concrete, and that the pipe lines, transporting the concrete to the forms, would be completely filled at all times, which would insure that the concrete would be delivered to its destination without segregation.

The concrete, as specified by the engineer for the project, Albert Kahn, was as follows: Class A — 1:1½:3 (by volume) and 6 gal. of water to produce 2,500 lb. per square inch minimum strength at 28 days; and Class B — 1:2:4 (also by volume) and 7 gal. of water to produce 2,000 lb. per square inch at 28 days.

Using 10 lb. of cement per batch, the engineers proceeded to determine a proper ratio of fine and coarse aggregates that would produce a concrete that handled easily without segregation. The ratio of water to cement was always kept constant. The trials showed that the proportions in the accompanying table gave the most economical concrete and at the same time a concrete easily placeable with a slump of 6 in. It was estimated that the strength of the concrete would be better than 3,000 lb. for the Class A concrete and between 2,500 and 3,000 lb. for the Class B.

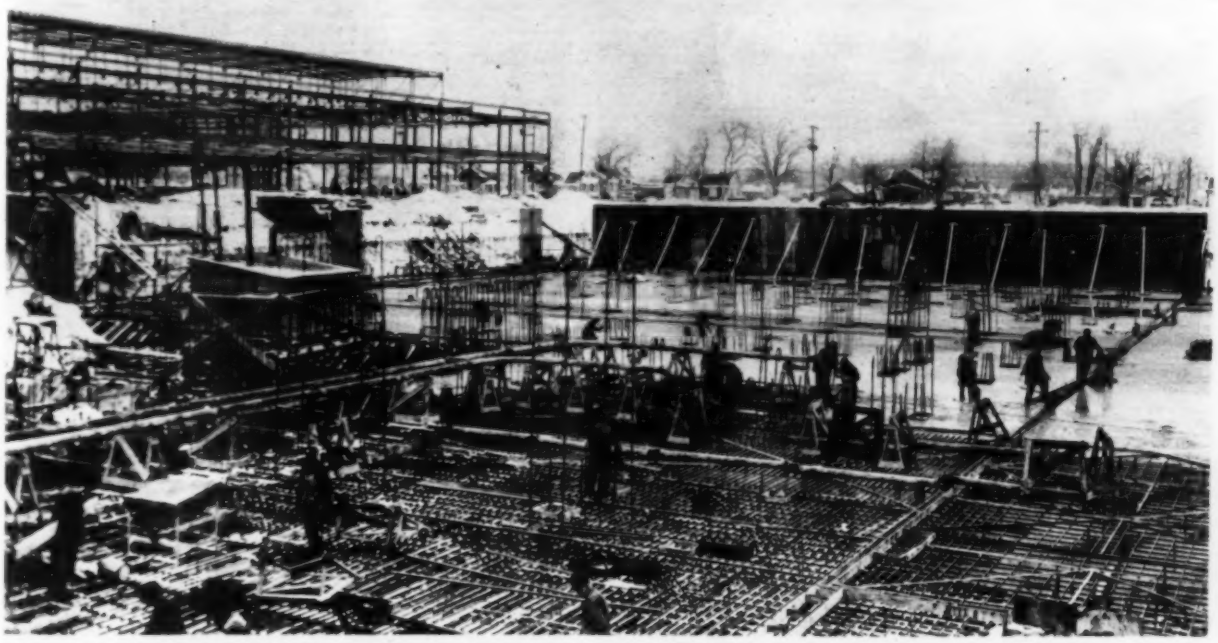
Concrete Proportion Table

Class of Concrete	*By Vol. (Specified)*	*By Vol. As Used*	*By Wt. As Used*	*Sks. Cement Per Cu.Yd.*	*Cement Saving Sks. Cu.Yd.*	*Wts. Used in Batches Lb.*
A	1:1.5:3	1:2.1:3.3	1:2.5:3.5	5.82	0.66	565:1,410:1,970
B	1:2 :4	1:2.95:4.3	1:3.4:4.5	4.58	0.70	470:1,600:2,150

The data was taken to the job, where the weights of materials, corrected for free water, were made to conform to the designed mix. The results were most gratifying in every respect. The Pumpcrete had no difficulty in pumping the concrete, the concrete was easily placed and gave compression strengths well above the requirements.

Although concreting was started in the latter part of the past severe winter and carried on throughout the rainy early spring, there were no tie-ups due to mud or cold. The heated materials were mixed into a warm concrete which did not give up an appreciable amount of heat during its passage through the pipe-line. Although the pipes could have been easily insulated, none was found to be necessary.

Jerome A. Utley is president of the company which bears his name, P. C. Darin is general construction superintendent, and George Baseman is superintendent of equipment. F. C. Falkner was the construction superintendent for the Utley company at Grand Rapids.



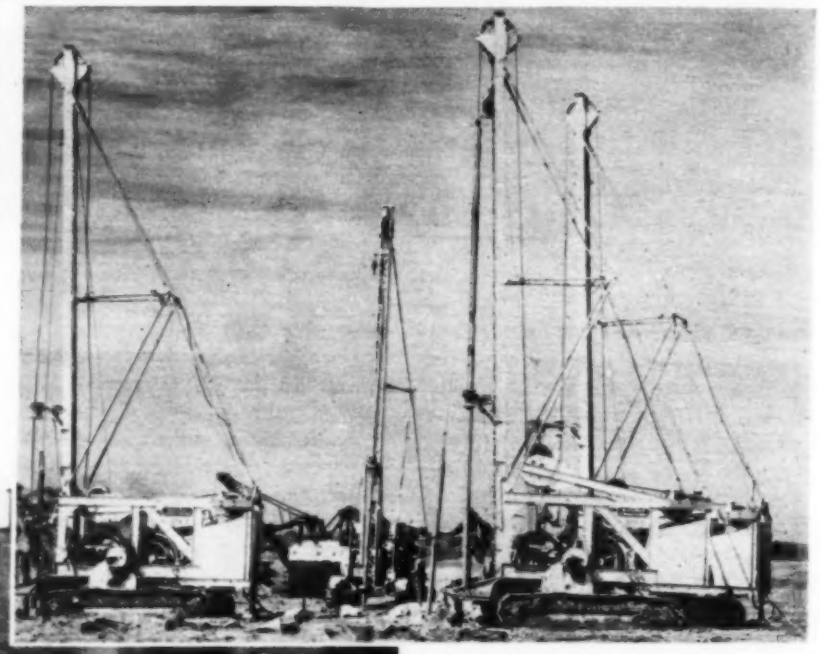
POURING FOUNDATION SLAB with concrete pumped through twin pipe lines. Total of 6,540 cu.yd. was placed in six days with twin Pumpcrete operating continuously.

Construction Equipment News

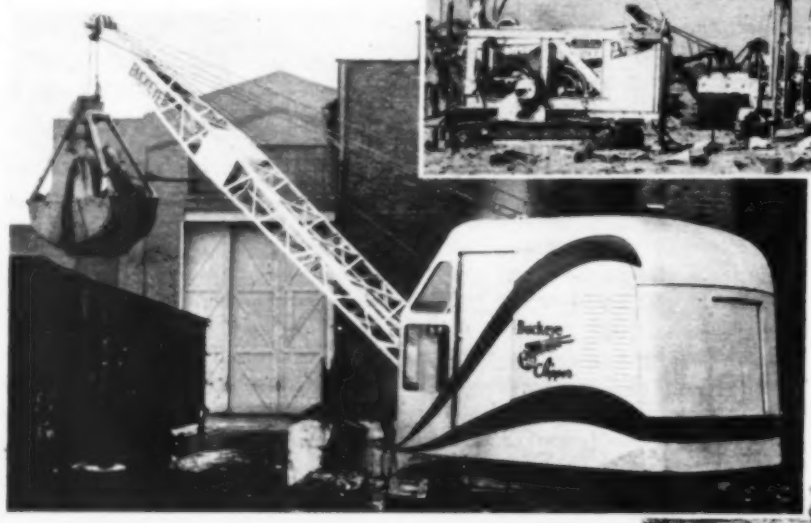
(All rights reserved)

Review of Construction Machinery and Materials for July, 1937

BLAST HOLE DRILL (right), for putting down 9- to 12-in. holes at fast drilling rate, swings up to 6,000 lb. of cable-tools, concentrating large amount of energy at bottom of hole. Where formation permits, machine drills larger diameter holes with wider spacings giving greater tonnage per foot of hole drilled and reducing preparation costs. With smaller holes necessary for good fragmentation drill produces satisfactory footage. Two features new to blast-hole field: (1) Power-driven tool wrench sets up and breaks tool joints entirely by power; (2) telescope derrick is raised by power from engine. Other features: rubber shock absorbers, rubber insulated sheaves, welded all-steel construction, wire-line cables, convenient controls. Diesel or electric power. — **Bucyrus-Erie Co., South Milwaukee, Wis.**

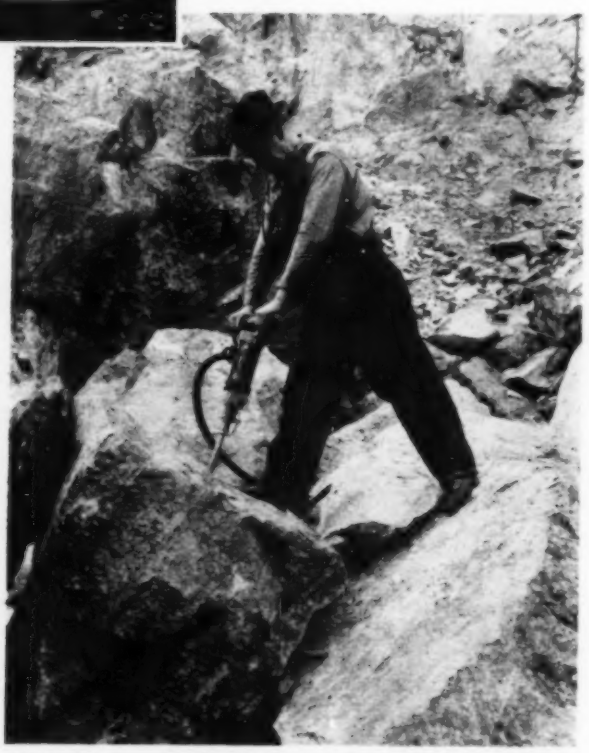


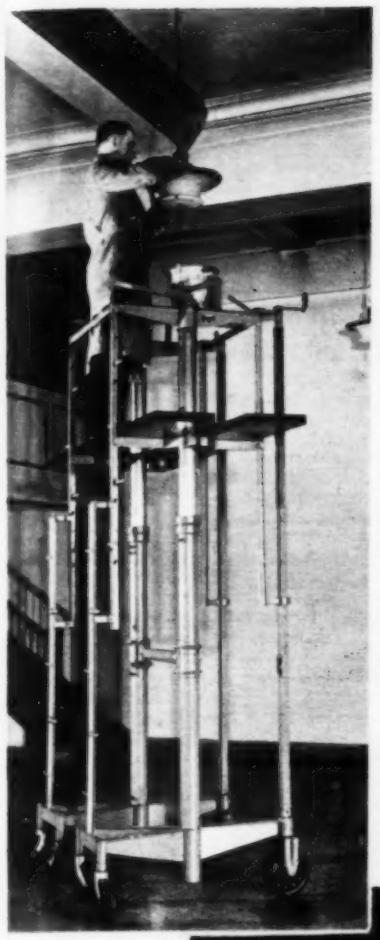
EXCAVATORS (below) of ½-, ⅝- and ¾-yd. capacities with shovel, crane, dragline, clamshell and trench-hoe attachments (Buckeye Clippers, Models 50, 60 and 70) have been designed to increase efficiency and production in this type of work and to make job of operator less tiresome. Unusual feature: Perfected system of control by metered vacuum from panel where small levers move at touch of operator. This system is claimed to eliminate trouble caused by extremes of temperature, small leaks or water in line. Other features: (1) Made with 100 per cent alloy steels, anti-friction bearings and heat-treated shafting, stripping machine of excess weight; (2) tubular dipper stick combines strength and flexibility; (3) automatic vacuum-controlled brakes. Comforts for operator: Air cushioned seat, convenient tool rack; handy compartments, heater for cold weather. — **Buckeye Traction Ditcher Co., Findlay, Ohio.**



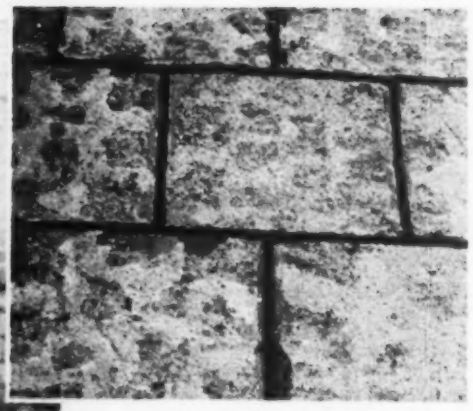
PNEUMATIC CONCRETE PLACER (below) for delivering concrete to forms by air pressure is especially adapted for such work as lining tunnels. After mixed concrete has been deposited in charging receptacle, horizontal sliding door operated by compressed air is forced against machined seat, sealing intake opening. Air jet cleans sealing door, keeping it free from concrete for perfect sealing. Worm feed in bottom of cylindrical receptacle, driven by Ingersoll-Rand air motor, forces concrete into discharge chamber where application of air carries batch of concrete through pipe line to point of deposit. Advantages claimed for worm-feed construction: (1) Concrete moved with minimum amount of air; (2) number of blocks in discharge line materially reduced; (3) output increased for given sizes; (4) headroom, width and length of machine for given capacity reduced to minimum; (5) one-operator control. Manufactured in ¼-, ½- and 1-cu.yd. sizes. — **Ransome Concrete Machinery Co., Dunellen, N. J.**

LIGHTWEIGHT DRILL (below) to be used in place of heavier drills for light rock drilling such as blockholing, trimming, scaling, sinking holes for conduits, pipes, railings and foundation bolts, maintenance and demolition work. Designed to work in soft, medium or hard rock or concrete. Said to use small amount of air, to have high drilling speed and exceptional blowing ability. Dry model weighs 30 lb. and is 19½ in. long. Weight of wet model, 32 lb. — **Ingersoll-Rand, 11 Broadway, New York.**

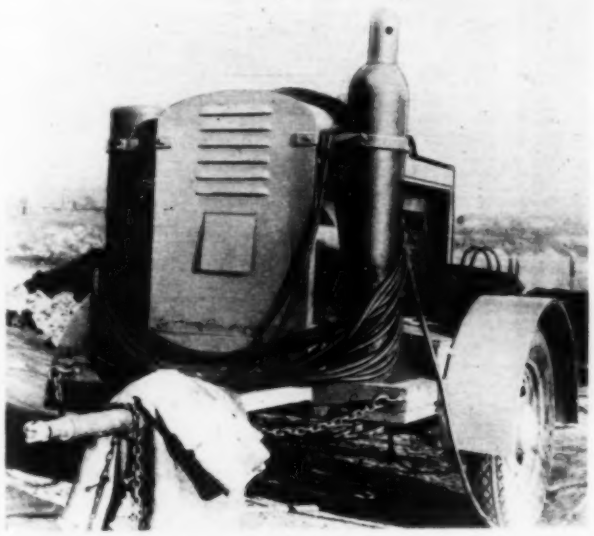




DEMOUNTABLE HYDRAULIC SCAFFOLD (left) called "DecoVator" provides building maintenance men with ladder and work bench assembly which can be transported from place to place by self-propelling mechanism. Made entirely of steel, light in weight and easily disassembled for quick transportation from job to job. Reach of one model ranges from 2 ft. 8 in. to 16 ft. and of another from 3 ft. 2 in. to 22 ft. Platform elevated by worker on it at rate of 8 ft. per minute and lowered at 10 ft. per minute. Travel speed, 50 ft. per minute. — **DecoVator Scaffolding Corp., 2988 E. Grand Blvd., Detroit, Mich.**



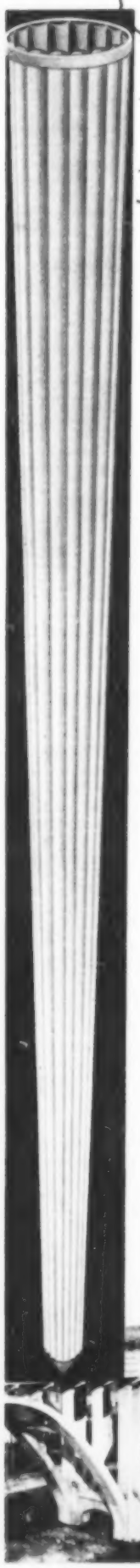
GRANITE-FACED CONCRETE PAVING BLOCK (above and inset). Large-size precast Ultimite units, 11⅞ in. square and 4 or 5 in. deep, are made of aggregate from granite quarry scrap and waste, with selected cubical shapes and sizes set in bottoms of forms to form durable wearing surface of which area is 60 per cent granite, surrounded by concrete. Corner stones for each block manufactured separately to produce true right angle. Weights are 50 lb. for 4-in. block; 62 lb. for 5-in. block, handled by one man with tongs. Joints per square yard of paved surface total only 23 lin.ft. for Ultimite block, as against 43 lin.ft. for smaller-size paving units. Vibration is part of block-casting process. Blocks develop compressive strength of 7,000 lb. per square inch at 28 days. Blocks are usually laid on ½- to ¾-in. dry mortar cushion course of one part cement to three parts sand, with ¼-in. joint spacing. Bituminous mix cushion may be used. Joint filler may be of three types: 1:3 cement-sand mortar; hot asphalt and stone screenings; premolded asphalt, bound with hot asphalt. Granite-faced pavement is designed to withstand heavy traffic at tunnels, bridges, station platforms or drives, service stations, steep grades.—**Ultimite Paving Block Corp. of America, 60 East 42nd St., New York, N. Y.**



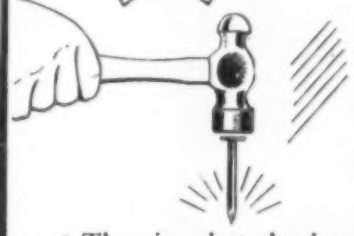
THREE PORTABLE TRAILER WELDERS, gasoline-driven 150-amp. capacity, were purchased by Detroit Edison Co. and fitted with oxygen and acetylene tanks set on each side of electric welding unit. This addition provided self-contained units for use both in gas and electric welding and cut the company's costs for this type of service an appreciable amount. All welding is now handled by three hired operators, each with his own portable welder and personal car. These men go to outside welding jobs and are paid on mileage basis for hauling welders. — **Harnischfeger Corp., Milwaukee, Wis.**

HAULING SCRAPER in 5-, 6-, 8-, 10- and 12-yd. sizes is made of all-welded heavy steel plate with box-type drawbar. Operated by cables from one- or two-drum power control unit mounted on tractor and powered from takeoff shaft on tractor. Cutting blade which feeds earth into bowl is adjusted to correct angle and proper depth from tractor operator's seat. After loading, bowl is lifted into hauling position, and apron on front of scraper is closed. Entire weight in transit is supported on six roller bearing wheels equipped with large tires enabling scraper to roll to dump with least amount of drawbar pull. At destination apron is raised by power control and load is dumped with scraper either in motion or stopped. Power necessary for pulling scrapers ranges from 35-40 hp. for 5-yd. size to 80-90 hp. for 12-yd. size. — **J. D. Adams Co., Indianapolis.**

ROLLER-BEARING JAW CRUSHER (below) (10x20-in.) is available mounted on either straight or goose-neck type truck for easy portability; on skids; on rigid frame elevator for permanent or semi-permanent installations; and with or without power plant or elevator. Self-aligning roller bearings sealed against dirt, dust, water and other foreign materials. Overhead eccentric action of crusher creates forced feed stroke downward, as well as forward, to force material through crusher, thus increasing capacity and insuring uniform product. Manganese steel crusher jaws. Reversible jaw plates, end for end. Alloy steel main shaft. All parts oversize with extra margin of strength. Readily adjusted to produce various sizes of materials. Toggle plate designed to withstand crushing of hardest rock. Should unbreakable material enter crusher, movable jaw swings open and allows it to pass through without damage. Horsepower required 25-30; r.p.m., 250; weight, 7,720 lb.; depth of moving jaws, 26 in.; of stationary jaws, 22 in.; width of jaws, 20 in. Capacity in tons per hour ¾-in., 4-5; 1-in., 5-7; 1¼-in., 7-9; 1½-in., 9-12; 2-in., 12-16; 2½-in., 18-25; 3-in., 25-35.—**Day Pulverizer Co., Knoxville, Tenn.**



"THEY DRIVE LIKE NAILS"



● That is what the head of a large engineering company told us recently after they had finished driving their first Union Metal Fluted Steel Pile Shells. They were driven in hard, compact sand without jetting.

Every hammer blow counts when you drive these light weight, tapered shells. Their great strength and rigidity, due to cold rolling and fluting, eliminates the use of a heavy mandrel. The full force of each blow is transmitted directly to the driving point.

Easy handling, fast driving—Union Metal Pile Shells will enable you to install cast-in-place concrete piling in less time and at lower cost.

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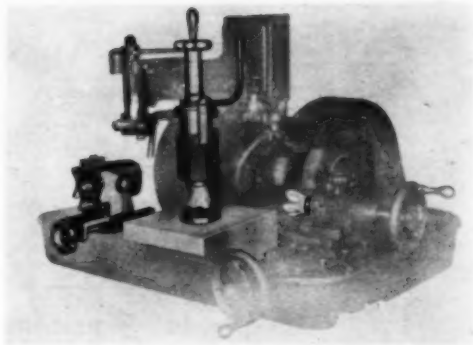
CANTON, OHIO

Viaduct, U. S. Route No. 30, Blaine, Ohio. Engineers: State of Ohio Highway Dept. Specifications approved by B. & O. R. R.

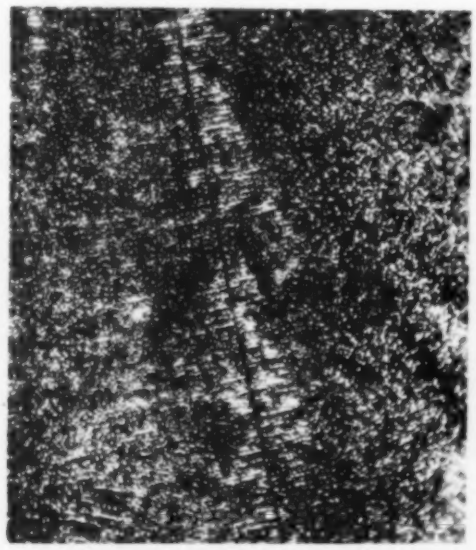
Construction Equipment News *(Continued)*

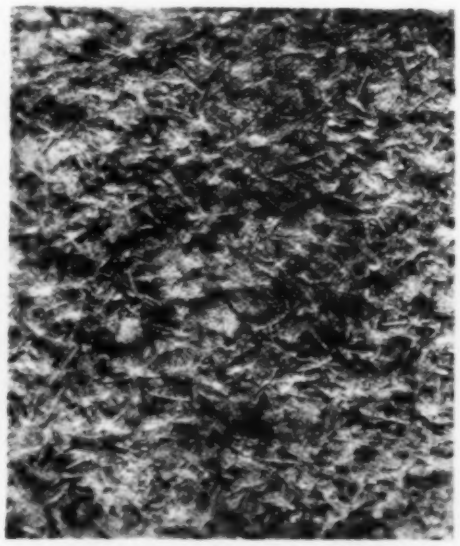
FLOOR SANDER, said to finish floors at lower cost, is heavy enough in itself (138 lb.) for fast, accurate floor sanding, eliminating need of manual control or addition of weights to keep drum in constant contact with surface of work. All parts of machine built to one-piece steel frame, insuring rigidity and lack of vibration. Sanding drum, 7 in. wide and 6¾ in. in diameter, is covered with resilient sponge rubber pad which prevents "pitting" of floor. Vise-like grip of specially designed clamp holds sand paper firmly to drum requiring no wedge to hold it in position. Efficient dust collecting is effected by use of separate vacuum system mounted integrally to frame and powered by independent universal motor. Handle adjustable for comfort and convenience of operator. Switch has 100 per cent overload capacity to insure freedom from frequent replacement. All movable parts mounted on ball bearings, grease-sealed from dust. — **Skilsaw, Inc., 3310-20 Elston Ave., Chicago, Ill.**



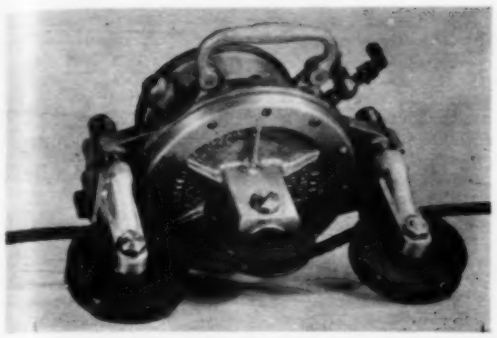
DETACHABLE BIT GRINDING ATTACHMENT for use on various types of bit grinders consists of holder for loading, barrel with expansion collet for gripping bit and rocking sleeve mounted on adjustable base. Alignment obtained by resting cutting edges of bit between two bars of loading fixture and inserting bit holder in loading casing. As expansion collet tightens to grip bit, holder slips into alignment stops and is then inserted into rocking sleeve with rocker rolls contacting radial cams. Dowel pin fits into sleeve groove to insure true grinding. Rocking of holder grinds reaming edge and one side of cutting edge. Rocker rolls contact radial cams during entire grinding operation so that bit is in proper contact with grinding wheel to produce straight cutting edge. Holder then is revolved 180 deg., simple operation repeated and bit ground. Gage ground by usual method. —**Sullivan Machinery Co., 307 N. Michigan Ave., Chicago.**

HIGH-SPEED PORTABLE CONVEYOR for contractors and highway builders is equipped with high pressure pneumatic truck tires so that it can be towed behind truck at great speed, reducing transportation costs and providing quick transfer from job to job. Flexibility makes it capable of handling variety of jobs in coal and material yards, gravel pits and in highway and excavating operations. Belt, 24 ft. long and 16 in. wide, is covered with 4-ply rubber and fitted with 1½x4½-in. steel angle cleats on carrying side. Belt capacity, 25 to 90 tons per hour depending on material handled and steadiness of operation. Powered by 3-hp. electric motor or 3- to 5-hp. gasoline engine. Discharge height, maximum 11 ft.; charging height, 13 in. Width overall, 7 ft. Approximate weight, 2,800 lb. with electric motor, 3,000 lb. with gasoline engine. — **Atlas Conveyor Co., Clintonville, Wis.**





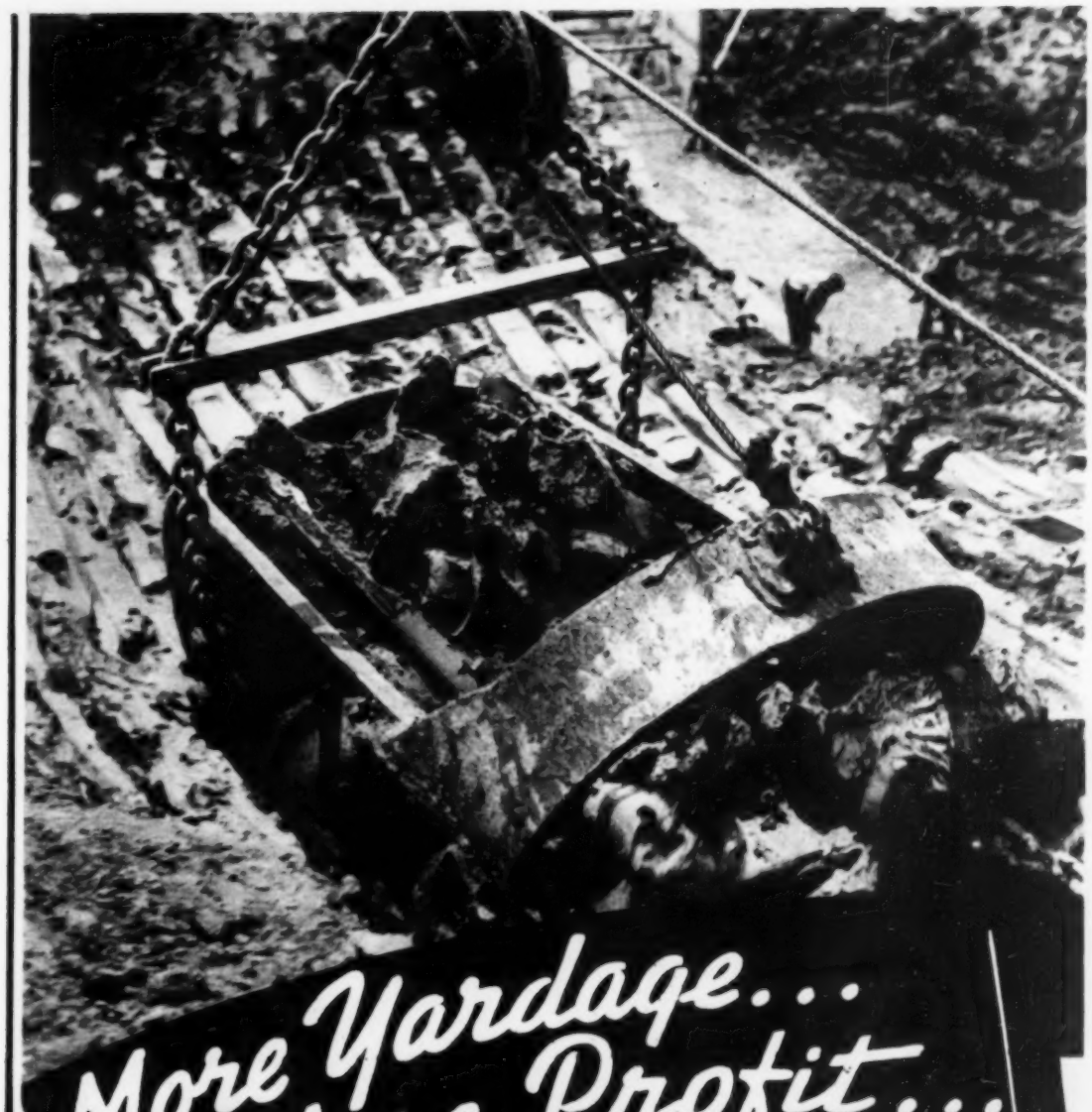
GALVANIZED PAINTGRIP SHEETS have all value of full-coated galvanized sheets with added protection of special insulating coating that keeps paint from direct contact with zinc surface. Result is galvanized metal that has good physical surface for mechanical adhesion, plus chemical neutrality which retards aging of paint. Available in any grade of galvanized sheets manufactured by company and supplied in two surface finishes, regular and extra-smooth. Forming qualities same as untreated galvanized sheets with corresponding weights of coating. Any good paint may be applied to sheets. If baked finish is wanted, suitable primer is recommended. Photos show surfaces of ordinary galvanized sheet **(left)** and of Paintgrip sheet **(right).** — **American Rolling Mill Co., Middletown, Ohio.**



TRAVELING LINE TENSION INDICATOR, for obtaining tensions or pounds load on small sized moving cables or wires, weighs 6¾ lb. with overall dimension of 12 in. Equipped with three roller bearing hardened steel wheels, two of which are attached to frame. Third wheel is suspended on sylphon bellows creating sufficient deflection in traveling line to indicate slightest variation in tensions or loads applied. Sylphon is connected to sensitive indicating gage making up closed vacuum loaded system. Special non-freeze, non-corrosive fluid used. Recommended for use on wire with maximum diameters not more than 3/16 in. — **Martin Decker Corp., Long Beach, Calif.**

VISIBLE RECORD FORMS for keeping social security data in shape for government inspection are said to be based on analytical study of law, on conferences with government officials and employees and on requirements of companies which have already set up record systems. Visible record book available for employer with less than fourteen employees; large size binder for from 30 to 50 employees; tray cabinets of required capacity for employers of 300 or more. Most important form is payroll record which every business must keep. Other forms: annual payroll summary, personnel form, unemployment tax record and employees' contribution record. — **Acme Card System Co., 8 S. Michigan Ave., Chicago, Ill.**

ALL-WHEEL DRIVE TRUCKS for heavy-duty service may be had in twelve four-wheel models, capacities from 2 to 10 tons, and in seven six-wheel types, capacities from 7 to 20 tons. Features: (1) Driving front axle; (2) auxiliary transmission of either two or three speeds forward; (3) standard transmissions of four or five speeds forward; (4) sturdy frames, finger-tip steering, dual rear tires. Power supplied by 78- to 180-hp. six-cylinder engines. All engines have seven main bearings. Westinghouse air brakes are standard equipment on some models; others have hydraulic brakes. Model shown is four-wheel-drive machine with payload capacity of 5 or 6 tons. — **Marmon-Herrington Co., Indianapolis.**



USERS REPORT 20% TO 50% INCREASED YARDAGE—READ WHAT THEY SAY:

***One AUTOMATIC user writes:*

"We were amazed at the way the AUTOMATIC Bucket handled the hard material, especially on the slopes. We feel sure that we can figure an increase of 25% in yardage with the AUTOMATIC."

***A Contractor reports:*

"Since putting on your AUTOMATIC, we are stripping 50% more material."

**From letters in our files*

You also can increase dragline yardage and profit, with a patented rounded front Page AUTOMATIC. Your equipment dealer will gladly recommend an AUTOMATIC best suited for your machine and job—or write us direct.

BUILT IN SIZES 3/8 TO 15 CUBIC YARDS

"DIG WITH A PAGE AUTOMATIC"

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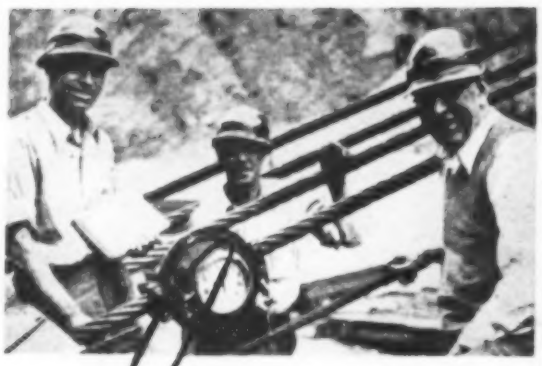
CLEARING POST OFFICE CHICAGO, ILLINOIS



IT'S THE *Actual* LOAD THAT COUNTS!

Theory is good in its place, but after all the *Actual Load* is what strains the cable!

The Martin-Decker Shunt Type Tension Indicator gives you the *actual* cable load accurately, quickly and without deadending . . . simply clamp it to the cable, then read the dial. It's as simple as that . . . and as fool proof!

AVAILABLE IN THREE SIZES:

miniature for lines and cables up to 3/16", capacity 200 lbs.

standard for wires or cables from ¼" to ¾", capacity 15,000 lbs.

heavy duty for wires or cables from ¾" to 2¼", capacity 250,000 lbs.

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. . . COMPLETE LISTS COVERING INDUSTRY'S MAJOR MARKETS

News from Manufacturers

ABOUT THEIR PRODUCTS

The publications, reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.

LOCOMOTIVE CRANES — **American Hoist & Derrick Co.**, St. Paul, Minn. (16 pp., illustrated). Capacity range from 7½ to 40 tons, powered by steam, gasoline, diesel or electric motors. Eight-wheel standard-gage or crawler-type trucks. Full-vision operator's cab. Applications illustrated by photos. Design features include interlocking gib ring, fully inclosed roller path, universal joint drive, large-diameter, cool-running friction. Company's "American Eagle" crane is small, compact 7½-ton capacity gasoline unit for medium-duty jobs.

• • •

STEAM DRIVEN COMPRESSORS — **Worthington Pump and Machinery Corp.**, Harrison, N. J. (20 pp., illustrated). Heavy-duty duplex units with piston displacements from 574 to 4,150 cu.ft. per minute, for pressures from 80 to 125 lb. per square inch. Design features include dual cross-head, feather valves, bronze tube inter-coolers, automatic cut-off steam valves, forced-feed lubrication for bearing surfaces, and automatic cut-off governor.

• • •

ROCK CRUSHERS — **Iowa Manufacturing Co.**, Cedar Rapids, Ia. (8 pp., illustrated). Heavy-duty, roller-bearing jaw crushers. Bearings completely sealed to keep grease in and dirt out. Safety devices as protection against "tramp" iron include toggle plate between pitman and base and shear pins in each flywheel. Crusher opening adjustable by hand wheel. Range of sizes of jaw opening are from 10x20 in. to 15x36 in.

• • •

ENGINE-DRIVEN WELDERS — **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh, Pa. (10 pp., illustrated.) Self-contained Flex Arc units, in 200-, 300- and 400-amp. sizes, with welding generator directly coupled to Chrysler industrial power unit. Performance curves. Automatic voltage control.

• • •

TWENTY-FOUR HOUR CEMENT—**Lone Star Cement Corp.**, 342 Madison Ave., New York, N. Y. (40 pp., illustrated). Service records of Incor high-early-strength cement, covering 10-year period since 1927 and including concrete pavement, tunnel lining, bridges, heavy-duty floors, loading docks, dock piling, reservoirs, buildings, foundations and other structures. Concrete cures or hardens in 24 hr. High early and ultimate strengths shown by core tests. Brief case histories of representative projects on which Incor cement was used. Notes on cold weather concreting results. Advantages claimed for high-early-strength cement include: 24-hr. service strength, reduced curing costs, winter economies, early removal of forms, better and more watertight concrete. The booklet is notable for the number and excellence of its photographic illustrations.

• • •

DIESEL ROAD MACHINERY — **Caterpillar Tractor Co.**, Peoria, Ill. (12 pp., illustrated.) Pictorial presentation of diesel tractors and other road-building machinery, including blade graders and auto patrols, at work. Drawbar horsepower of tractors ranges from 35 to 95 hp. for operation of bulldozers, wagons, rippers and scrapers and other equipment. Series of photos illustrates construction of pioneer road from start to finish.

• • •

HEAVY-DUTY BLACK PROTECTIVE COATING — **Quigley Co., Inc.**, 56 West 45th St., New York, N. Y. (8 pp., illustrated.) For application to steel surfaces by brush or spray to prevent corrosion; coverage approximately 350 sq.ft. per gallon. No prime coat necessary. Resists moisture, acids, alkalies, sulphurous fumes. For protection of industrial, railroad and marine structures and equipment. Applicable to iron, steel and other surfaces.

ROOFING AND SIDING — **Johns-Manville**, 22 East 40th St., New York, N. Y. (11 pp., illustrated.) Cutting maintenance costs on industrial roofing and siding with J-M corrugated Transite, an asbestos-cement composition, light gray in color, that is incombustible, weatherproof and resistant to corrosion. How Transite can be applied by average workmen is explained with aid of photographs and full page of drawings of construction details. Special accessories seal all joints and ridges. Product is available in flat, as well as corrugated, sheets. The latter are furnished in widths of 42 in. and lengths from 3 to 11 ft.; weight 4.1 lb. per square foot.

• • •

FAN-COOLED SQUIRREL-CAGE MOTORS — **Westinghouse Electric and Manufacturing Co.**, East Pittsburgh, Pa. (4 pp., illustrated). These motors in sizes from 1 to 200 hp., employ a new heat exchanger principle of cooling, self-cleaning ball bearings, tested insulation with taped end turns and corrosion resisting construction for general use indoor or outdoor where foreign matter would be harmful to the windings.

• • •

VISIBLE RECORD EQUIPMENT — **Acme Card System Co.**, 8 South Michigan Ave., Chicago, Ill. (12 pp., illustrated). Check list of questions relating to office records and filling, covering stock and inventory, purchases, production, credits, accounts and personnel. Equipment of visible record type includes tray cabinets, card books, revolving stands, desk stands and wall brackets.

• • •

ASPHALT ROADS — **Shell Eastern Petroleum Co.**, 50 West 50th St., New York, N. Y. (40 pp., illustrated.) Advantages of Colas, an asphalt emulsion applied cold as a binder for road construction, maintenance and repair. Details of physical properties and summary of construction principles, with tabulation of quantities per square yard of coarse stone, Keystone, chips and Colas emulsion. Specifications for penetration construction, road mix, premixed macadam, and surface treatments. Notes on patching and repairs by penetration and with premixed materials. Application to treatment of airport surfaces, driveways, footpaths and tennis courts.

• • •

PIPE THREADING EQUIPMENT — **Oster Manufacturing Co.**, Cleveland, Ohio. (76 pp., illustrated.) Complete line of Oster-Williams pipe- and bolt-threading equipment. Welding equipment in form of clamps, assembly benches and gas-cutting machines. Hand tool stocks and dies, portable threaders, power machines.

• • •

PNEUMATIC TIRES FOR EARTH MOVING — **B. F. Goodrich Co.**, Akron, Ohio. (8 pp., illustrated.) Super-traction truck tires designed for earth-moving service. Specifications and data for tires in sizes from 6.00-20 (6-ply) weighing 35.3 lb. and with a carrying capacity of 1,400 lb. to 18.00-24 (20-ply) weighing 507.5 lb. with a carrying capacity of 16,000 lb. Advantages claimed are positive, non-skid traction, self-cleaning tread, long wearing tread, triple protection from sidewall bruises and overload breaks. Useful table on load ratings and inflation pressures for both highway and off-the-road service. Notes on tires for road graders in addition to trucks.

• • •

RUST ARRESTOR — **Truscon Laboratories**, Detroit, Mich. (4-p. folder, illustrated.) For protection of steel and iron a fluid named "Bar-Ox Formula 97" is applied previous to painting to neutralize activity of rust and prevent it coming through paint film.

• • •

GUIDE FOR SHEET METAL WORKERS — **Carnegie-Illinois Steel Corp.**, Pittsburgh, Pa. (63 pp., illustrated.) Booklet designed to give useful information on properties and uses of U. S. Steel Corp.'s galvanized black ternes and stainless steel. Advantages of copper steel alloy in resisting rust. Chapter on galvanized sheets and range of uses, with tables of weights for different gages. Duct work tables for steel sheets in heating and ventilating installations. Chapters on black sheets and terne sheets with tabulated data, and examples of roofing uses. Notes on painting sheet metal. Sketches illustrating typical roofing details. Chapter on stainless steel, with advice on cutting, forging, punching, shearing, riveting, soldering and welding. Uses of stainless steel summarized.

"I've run my P&H on all kinds of jobs, digging basements, stripping and loading materials, and never had to worry how tough the digging was. We always got big production."
—N. S. Carpenter.

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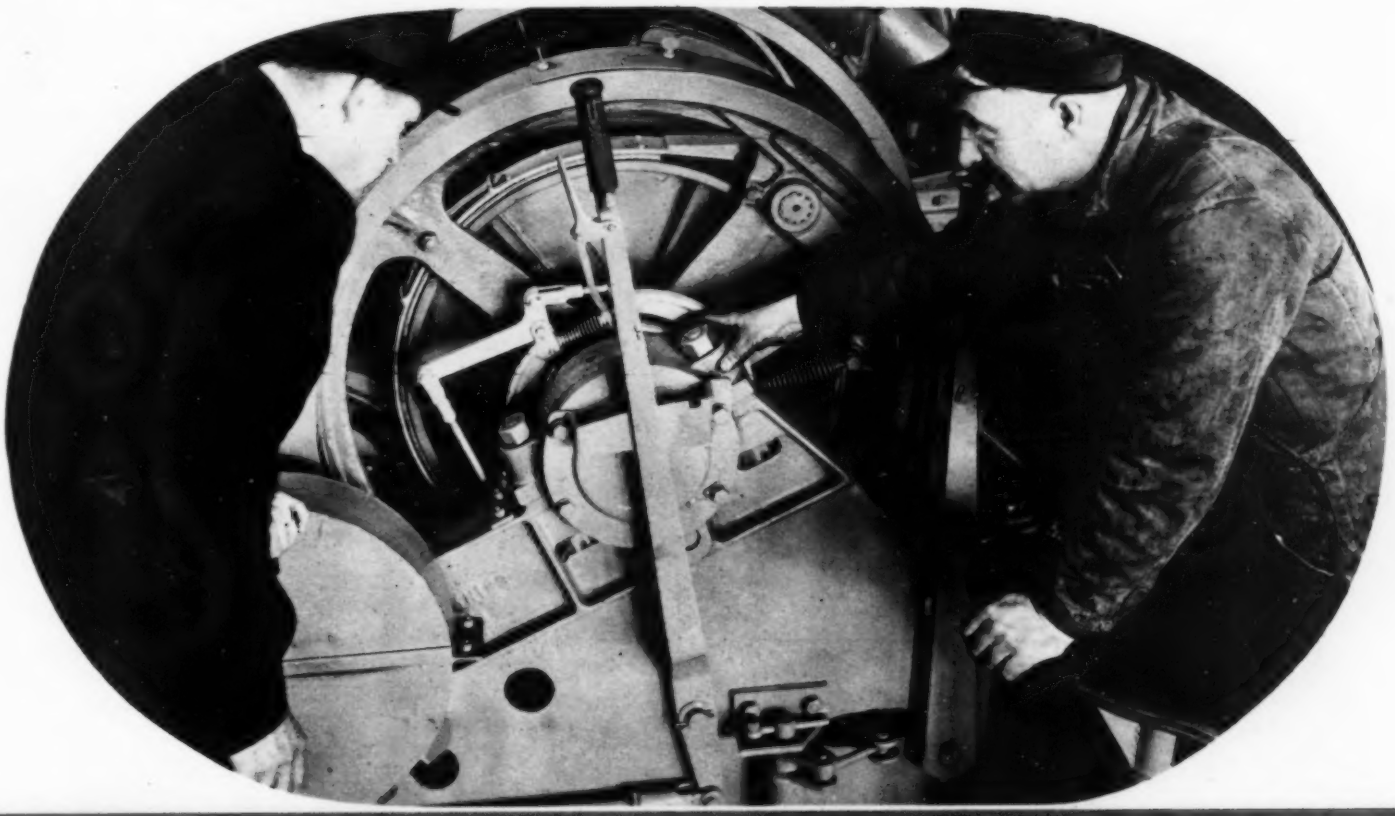
NO DRAGGING
NO CHATTERING

WITH THESE

P&H SPLIT SECOND CLUTCHES



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● These split-second clutches have full floating, full releasing shoes, perfectly equalized. They can't grab or drag. Bands can't wear unevenly. You can "feel" the clutch at all times. It takes only a few minutes and a few cents to replace brake linings. The first excavators to use this better type of clutch are the P&H Pacemakers—built by the Harnischfeger Corp.

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Three 8-year-old TEXACO Sheet Asphalt pavements in the city of Ashtabula, O., laid by Koski Construction Company.

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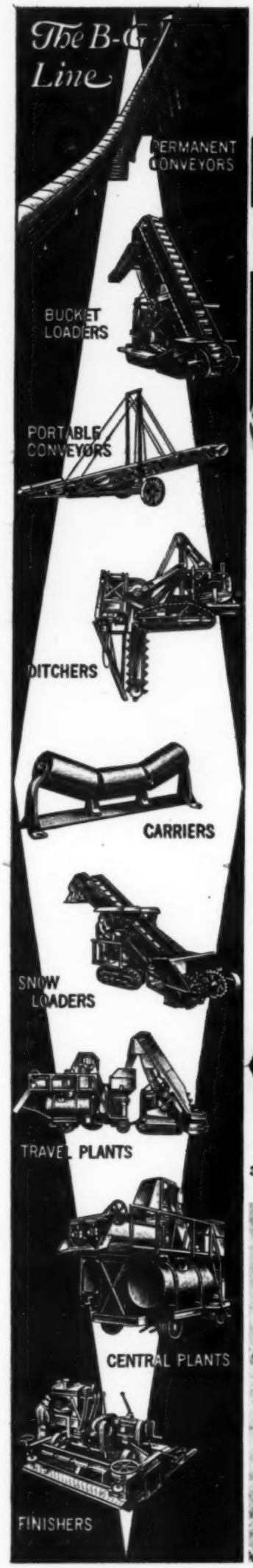

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THE primary advantage of the Bucket Loader is simple—it is the cheapest means of loading bulk material. It will probably pay for itself even though you have other equipment now being used for loading. It is generally regarded as one of the most valuable tools for contracting. In addition to low cost, high capacity loading, it is advantageously used for screening, stripping, light excavating, accurate grading, backfilling, etc.

The B-G 82 Bucket Loader is an outstanding achievement in equipment design. Synchronized Feeding gives higher capacity with less power consumption; the Automatic Overload Release protects the machine, eliminates delays; Slow Crowding Speed gives easier, more efficient operation; Fast Traveling Speed saves money and time; Tank Type Chassis Frame gives greater strength; and encloses all driving mechanism; Floating Boom allows crowding thrust to go direct from crawlers to feeding end; the Full Crawler Mounting gives maneuverability that saves time on every move; and the B-G Snow Loader boom can be mounted on the same chassis.

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or does your operator run the shovel?

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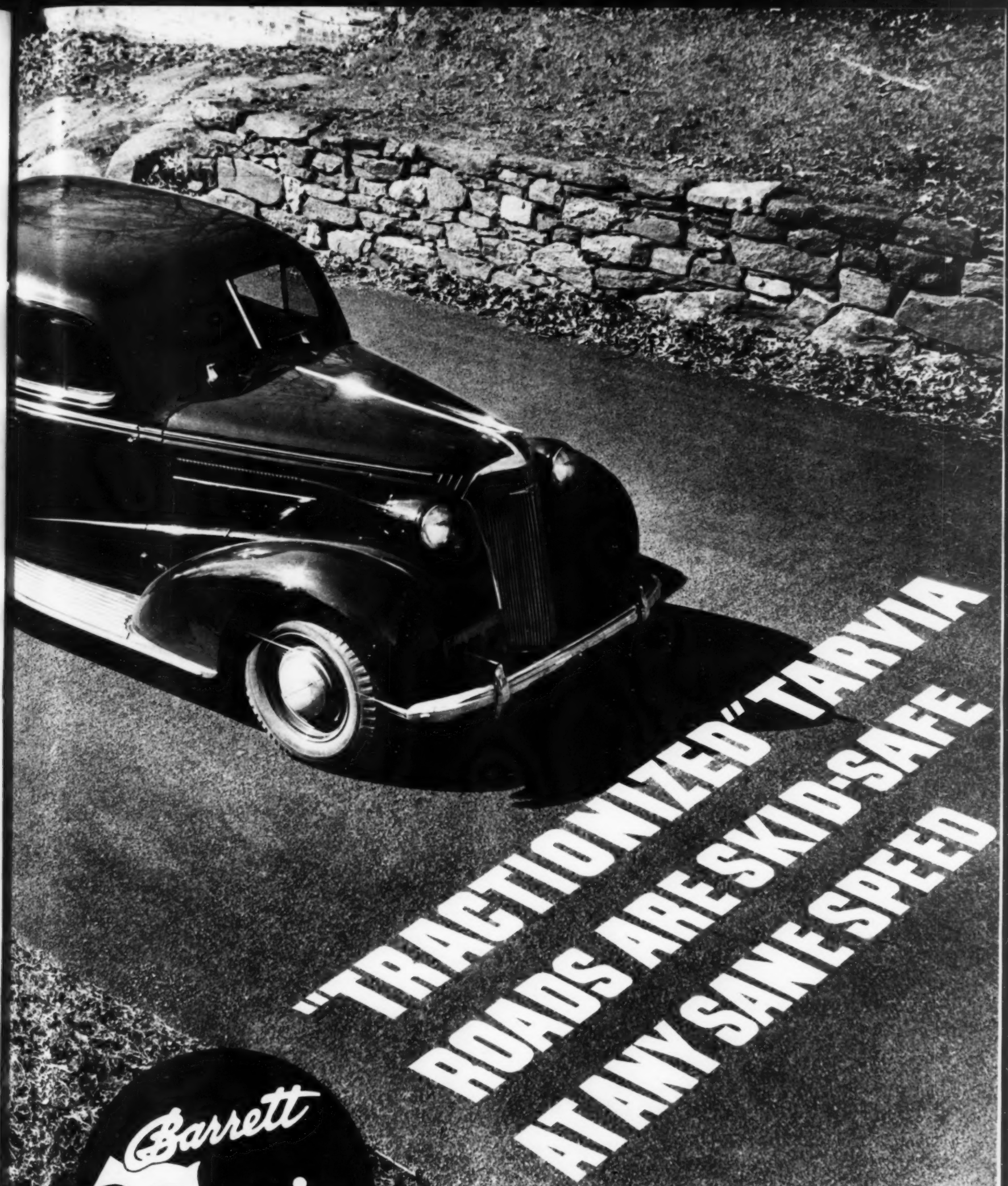
Model 80 (shown above)	¾ Yd.
Model 100	1 Yd.
Model 125	1¼ Yd.

BYERS
MODEL "80"

THE SHOVEL THAT IS ALWAYS BUSY



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GOOD ROADS
AT LOW COST

THE BARRETT COMPANY New York Chicago Birmingham Boston Detroit Philadelphia Buffalo Lebanon Rochester Baltimore Minneapolis Cleveland Columbus Providence Toledo Youngstown Syracuse Hartford St. Louis Milwaukee Cincinnati Bethlehem Portland, Me. Norwood, N. Y. In Canada: THE BARRETT COMPANY, Ltd. Montreal Toronto Winnipeg Vancouver

SMOOTH CONCRETE SURFACES *with this new form material*

a LIGHT *material for* HEAVY *construction*

Here's a form material that does the job *right*. That's what contractors the country over are finding in revolutionary new Super-Harbord Plycrete—the plywood that starts where ordinary plywood ends.

Super-Harbord gives a *smooth job*. Smooths out construction costs, too, because of its extreme re-usability — and because smoother surfaces and tighter joints minimize costly rubbing and finishing once the pour is made. Hot-prest with a resinoid bond absolutely insoluble in water — Super-Harbord is *guaranteed against ply-separation* . . . resists greater stress and strain because of its laminated strength.

Take the cue of contractors from coast to coast . . . *save* with Super-Harbord.

Communications addressed to Harbor Plywood Corporation in any of the following cities will receive prompt attention.

BRANCHES: Atlanta, Chicago, Indianapolis, Milwaukee, Philadelphia, Pittsburgh, Cincinnati, Louisville, Jacksonville, New Orleans.

REPRESENTATIVES: Cleveland, Columbus, Toledo, Baltimore, Washington, D. C., Worcester, Kansas City, Omaha, San Francisco, Los Angeles, Billings.

SUPER-*Harbord*

MAIL THE COUPON TODAY *for helpful data*

HARBOR PLYWOOD CORPORATION, Dept. CM. Mills and General Offices, Hoquiam, Washington.

Name.....

Address.....

Material Dealer.....

JUST PRESS THE BUTTON

FOR INSTANT AIR POWER

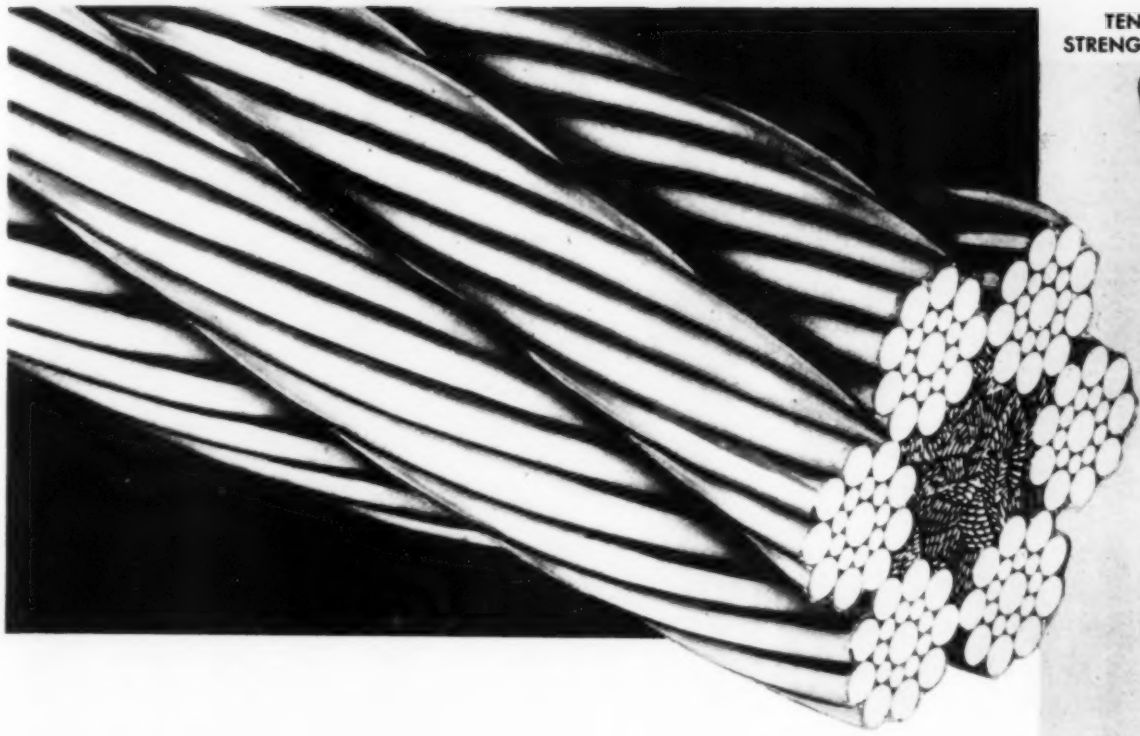
SCHRAMM 105 DeLuxe "Utility" Compressor. Insert showing instrument panel with gauges and starting button.

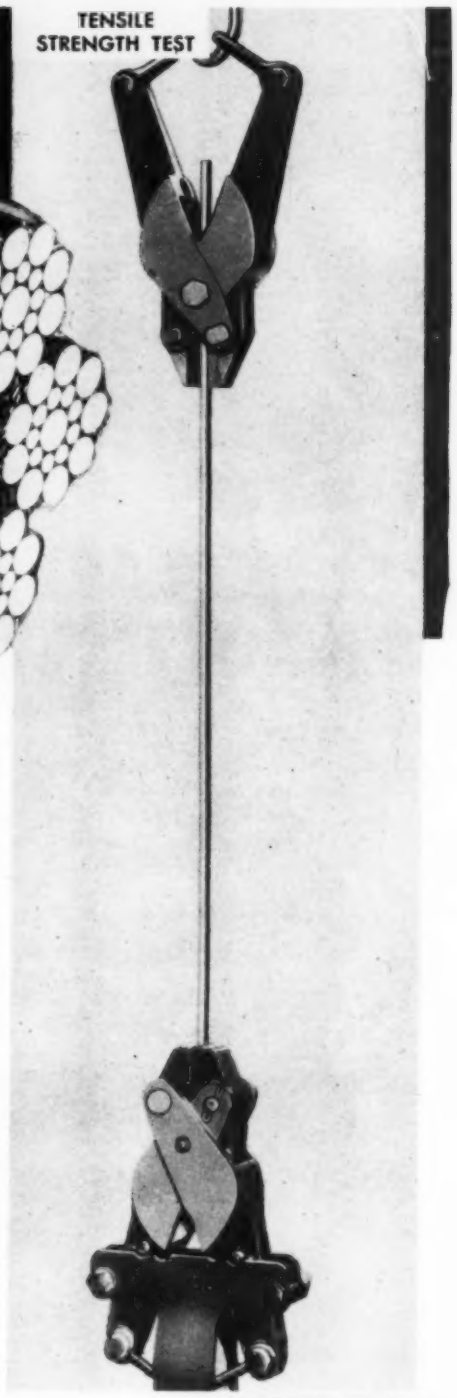
For the first time, SCHRAMM "Utility" Portable Compressors present electric self-starting equipment as a standard feature. Self-Starting means air on the job in a few minutes with time and labor saved in addition to the feature of safety. SCHRAMM "Utility" Compressors are available in sizes 85, 105, 160, 210, 260, 315 and 420 cu.ft. actual air deliveries and can be mounted on any one of seven mountings.

Write for SCHRAMM Bulletin 3700-CJ.
SCHRAMM INC., West Chester, Penna.

SCHRAMM

AIR COMPRESSORS





WE TESTED THIS 450 TIMES

To prove its Quality

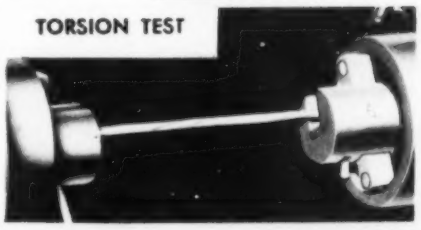
JUST as each part of a well built machine* must be tested individually before it is accepted, so each individual wire in American Tiger Brand Wire Rope is tested at least 3 times, in addition to test for size, before it can pass to the stranding machines.

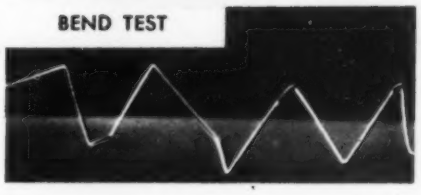
Your work puts wire rope to the severest tests. It must string or reeve easily and quickly . . . spool well . . . avoid whipping at high speeds . . . take the terrific jerks of starting and stopping.

And it is these qualities in American Tiger Brand Wire Rope which have given it a dominant position in the field—qualities which have been built into it by engineers whose wealth of experience is backed by over 100 years of wire making.

American Tiger Brand Wire Rope is available in either Standard (non-preformed) or Excellay (preformed) constructions.

***USS American Tiger Brand Wire Rope is a machine, more depended on than many. It fits the definition "Any combination of mechanism for utilizing or applying power."**



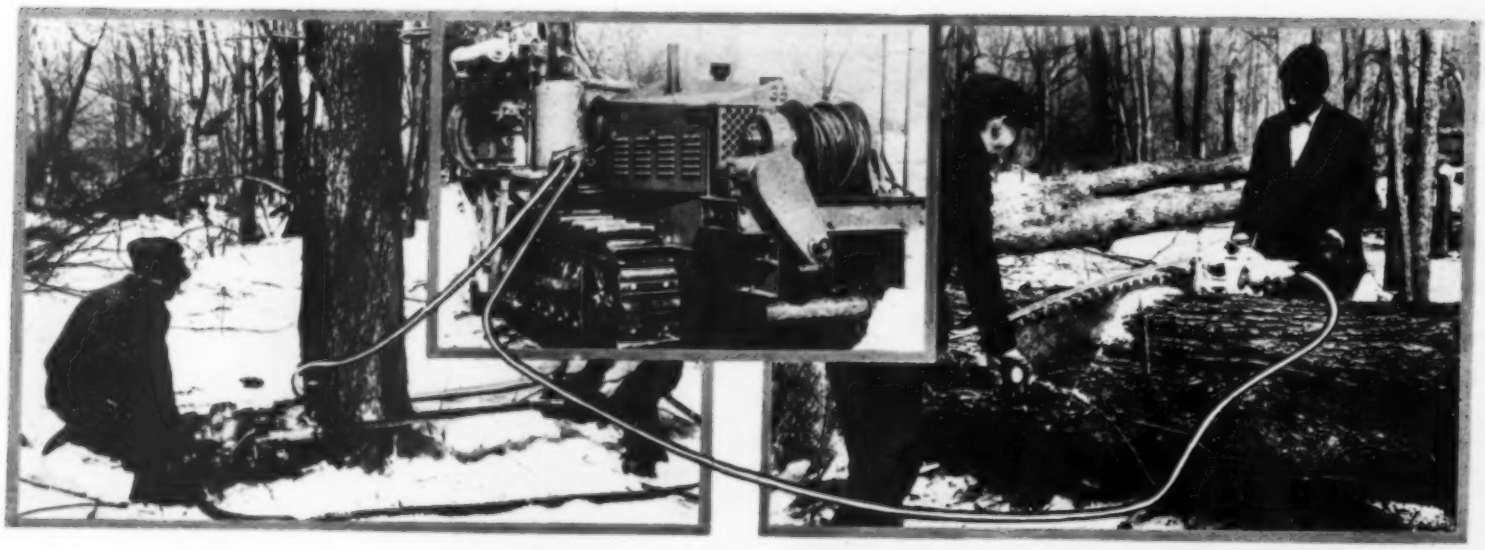


AMERICAN TIGER BRAND WIRE ROPE

American Tiger Brand Wire Rope. Electrical Wires & Cables. Amerclad All-Rubber Cables. Aerial Tramways. Tiger Wire Rope Slings. Tiger Wire Rope Clips.

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York
COLUMBIA STEEL COMPANY
Russ Building, San Francisco
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL



U. S. DECLARES WAR ON DUTCH ELM DISEASE

U. S. DEPT. OF AGRICULTURE USES

WOLF PORTABLE SAWS

● Speed, mobility, economy and ease of handling were the prime requisites in the selection of saws for cutting up and cutting down the great number of Elms. The Department selected Wolf Portable Saws.

Declare war on your Timber Cutting Costs

Wolf Portable Saws are not experimental equipment — not untried. They have proved their efficiency and economy on big Highway and Bridge and other construction jobs, cutting of piles both above and below water (with divers operating them). Wolf Portable Saws are made for Air, Gas or Electric Drive. Their labor saving rapid action quickly repay their costs — and you'll find no job where timber is used complete without them. Anyone can run a Wolf Saw like a veteran. Famous for compactness, simplicity. Easy to handle, well balanced, safe and fast. Made in 16", 24", 36" and 48" capacities. Write today for full information.

REED-PRENTICE CORPORATION
WORCESTER MASS.

WARCO Scoops

The Economical and Rapid Dirt Movers

A new and useful Attachment, shown in the insert at the left, Locks the Scoop Bowl in Loading Position, relieving the operator from holding the bowl in the ground. The load itself trips the lock and permits the bowl to snap back into carrying position. Sold as extra equipment also applicable to WARCO One and Two Yard Scoops in the field.

W. A. RIDDELL CORPORATION • BUCYRUS, OHIO

GREAT GUNS !

Bearing Failures Avoided When You Fight Friction With These Modern Weapons!

There are special Alemite Guns to handle every lubrication requirement on any construction equipment! Use them to speed lubricating—to cut operating costs—to avoid repairs—and to assure uninterrupted operation.

Look at the mud on that tractor! Yet see how easily the operator is forcing clean, fresh lubricant to every part of the bearing surface with an Alemite Volume Pump—flushing out the old, worn grease at the same time! Alemite Guns are at their best where the conditions are toughest—they're built as your construction machinery is built—to stand up under the hardest of hard use. They're GREAT GUNS for any construction lubrication job!

More than 98% of all modern construction machinery is factory-equipped for Alemite Lubrication! Keep those good machines of yours running for all the years of service the manufacturers built into them! See that you have plenty of Alemite Guns on every job, so that no machine goes unlubricated for want of the right gun at the right time! Use the coupon now to send for our new FREE manual—"Alemite Controlled Lubrication,"—it gives you complete information about *every Alemite System.*

ALEMITE
A Division of Stewart-Warner Corp'n.
1840 Diversey Parkway, Chicago, Ill.
Stewart-Warner-Alemite Corporation of Canada, Ltd.
Belleville, Ontario, Canada

Alemite Volume Pump No. 6536
Designed especially for tractor track roll bearings. Holds 35 lbs. fluid or semi-fluid lubricant; delivers on both up and down strokes of pump. Patented pressure release saves hose. Hose fastens to fitting on pump for easy carrying. Develops 1,000 to 3,000 lbs. pressure per sq. in.

Alemite Gat Guns
Lever-operated, with ball-jointed hose. Gun shown is high pressure type (5,000 lbs.). Capacity app. 1-lb. For use on Alemite Pin Type fittings. Also available with Button Head coupling and for volume delivery.

Alemite Hydraulic Gun
Wherever high pressure is needed this Alemite Hydraulic Gun works quickly and efficiently. Operates with one hand. Can't slip off. Develops up to 10,000 lbs. pressure per sq. in.

Alemite Dot Gun
Built specially for use on heavy duty construction machinery. Develops up to 3,000 lbs. pressure per sq. in. For Alemite-Dot fittings.

ALEMITE

REG. U. S. PAT. OFF.

WORLD'S LARGEST MANUFACTURERS OF LUBRICATION PRODUCTS

ALEMITE—*A Div.* Dept. F
of Stewart-Warner Corp'n.
1840 Diversey Parkway
Chicago, Illinois
Please send my FREE copy of your new manual, "Alemite Controlled Lubrication."

*Name*_____
*Address*_____
*City*_____ *State*_____
*Firm Name*_____

Enjoy Horace Heidt and his Alemite Brigadiers every Monday evening, over Columbia Coast-to-Coast Network. See local papers for time of broadcast.

"YARDS AHEAD"

KEEP GOING WITH Snap-on Tools

Just as the power shovel is "yards ahead" of the old fashioned spade, so are Snap-on tools the last word in the speedy servicing of construction machinery of all kinds.

Snap-on tools are unsurpassed in power, speed and safety. Typical are the Extra Heavy Duty Units shown above. No. 73 Ratchet Wrench and 18 sockets to match, 1 7/16" to 3⅛". 36 inches of powerful leverage breaks loose rusted-on nuts and bolts or pulls them up tight.

Keep going with Snap-on Tools . . . over 1700 in FREE 136 page 1937 catalog. Snap-on builds a complete line of hand tools — available through its own distributing warehouses located in 37 principal cities. See Snap-on Tools in your phone directory or mail coupon below.

Snap-on Tools, Inc.
Kenosha, Wis.

SEND THE COUPON

Without obligation
☐ Have representative call and demonstrate
☐ Specially interested in.....
☐ Free catalog, please
Name.....
Firm.....
Address..... CM-7

$983.14

the City of New York might **NOT** *have had!*

RICHMOND SCREW ANCHOR CO, INC.
TIME AND LABOR SAVING CONSTRUCTION DEVICES
BROOKLYN NEW YORK
EXACTLY ★★★ 983 14/100
PAY TO THE ORDER OF
TO THE NATIONAL CITY BANK OF NEW YORK
NASSAU BRANCH 6-74 10 COURT ST. BROOKLYN, N. Y. 1-8

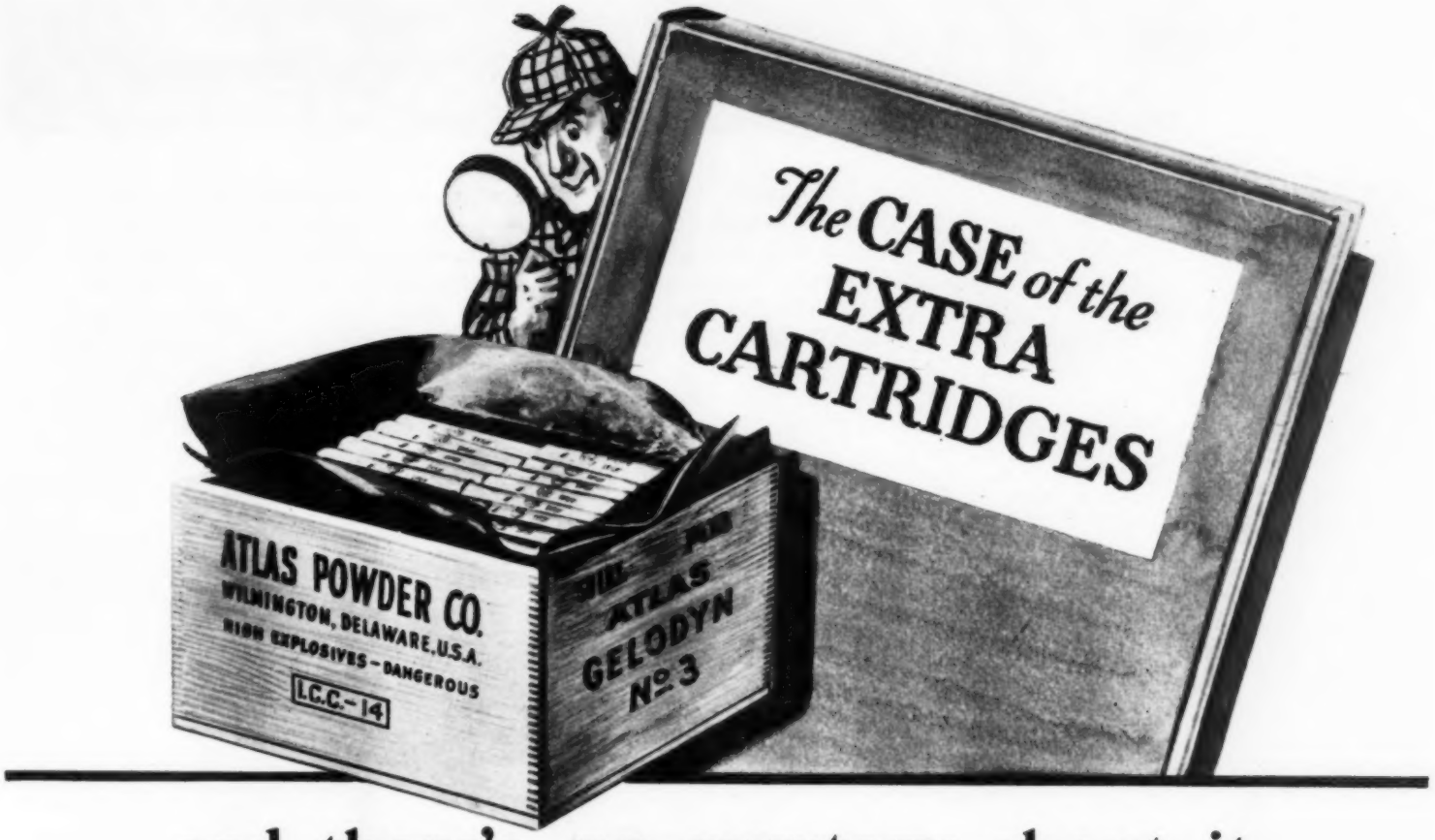
Well on to a thousand dollars is a lot of money in any man's language — especially if it's spent needlessly.

But at least that amount of money would have gone to waste in the construction of New York City's Randall's Island Stadium — IF RICHMOND HAD NOT SUPPLIED THE FORM-TIES.

For Richmond Screw Anchor Co. — besides affording the benefit of many years of practical form-tie experience — refunds one hundred cents on every dollar invested in form-tie accessories. Bolts, washers, wrenches, cones, wedges — all these are loaned without rental charge — all these are returnable to us at their full purchase price. The check reproduced above gives an idea of just how much money those accessories may entail.

Whatever the nature of your construction job, investigate Richmond tying devices and how they can cut down your construction costs. Drop us a line outlining your problem — there's no obligation.

RICHMOND SCREW ANCHOR CO., INC.
Tying Devices for Concrete
241-251 BUSH STREET BROOKLYN, NEW YORK



. . . and there's no mystery about it . . . anyone can detect the savings offered by

ATLAS GELODYN

Cartridges run about 95 to the case in standard 40 and 50% ammonia gelatin explosives. Cases of Gelodyn No. 3 average more than 120 cartridges—25 *extra*—so, if you're cost-minded you'll want to get Gelodyn-minded!

Higher cartridge counts of Gelodyns mean savings on many operations.

For instance, Gelodyn No. 3 frequently can be substituted cartridge for cartridge with ammonium nitrate type 40% Gelatin—and a case of Gelodyn gives over 20% more cartridges.

Gelodyn is highly water resistant and plastic. It has satisfactory fumes for underground work under all except the most severe conditions.

Gelodyns are well worth thorough trial.

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

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ATLAS EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

Killefer road equipment

- Revolving Scrapers
- Revolving Rippers
- Regular Rippers
- Road Discs, or Planers
- Compacting Harrows
- Oil-Mix Cultivators
- Ditchers
- Mole-Drain Machines

■

Write for Literature

IDEAL for small jobs, finishing, clean-up work, land leveling, small excavations, etc. Five models with generous strength. Capacities 18 to 37 cubic feet. Weights 875 to 1500 lbs. Widths 4′ to 8′. For tractors of 15 to 40 HP. All sizes provided with our patented latch and a loading lock for hard digging. Well braced smooth rolling bowl. Hitch permits short turning. Size of load adjustable. We also build scrapers in two heavier types. Write for folder 21 DA.

Sold by "Caterpillar" Distributors everywhere. Killefer Mfg. Corp. Ltd., Los Angeles, Cal., Peoria, Ill.

20-Series Scraper

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6 REASONS why **RELIANCE will give you the MOST SERVICE for the lowest ultimate cost...**

WE scrapped OLD IDEAS to give better service —longer life

Reliance 3 Wheel Rubber Tired Sweeper

Designed especially for preparing highways for resurfacing

1. Three wheel chassis provides 3 point suspension, giving short turning radius, making unit extremely easy to handle and steer.
2. New method for raising and lowering broom providing quick, easy, positive control.
3. Broom mounted diagonally across frame at point usually occupied by rear axle; no counterweight required.
4. Frame all steel construction, of great strength and durability, yet considerably lighter than similar equipment of other types.
5. The broom is engaged or disconnected through jaw type clutch. Control levers within easy reach.
6. Clutch held firmly in position when operating broom, by a heavy coil spring.

The Reliance is backed by 30 years manufacturing experience. It is the BEST BUY in today's street sweeper market! Reliance offers a complete line of Rock Crushers; Bucket Elevators; Revolving Screens; Scarifiers; Storage Bins; Pulverizers; Car Unloaders; Chip Spreaders; Heating Kettles; Bin Gates; Feeders; Belt Conveyors; Grizzlies; Air Separators; Sand & Gravel Spreaders; Wash Boxes.

UNIVERSAL ROAD MACHINERY CO.

KINGSTON, N. Y.

New York Office **114 Liberty St.**

COMPARE THE DETAILS WHEN YOU BUY TRUCK MIXERS

CONVENIENT CONTROLS

EASY and rapid operation, fore and aft.

EASY CLEANING

SIMPLE to keep clean. Drum interior designed to prevent building up with concrete with ordinary care.

TIGHT DOORS

MACHINED steel door seals which remain true and will not leak. No wrench required for operation.

ROLLER BEARINGS

SEALED against dirt and grit. No maintenance required for bearings that support the truck mixer and its load.

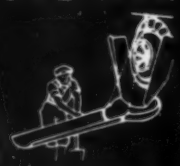
WATER MEASUREMENT

IMPROVED for greater accuracy of water measurement under all operating conditions.

WATER DISTRIBUTION

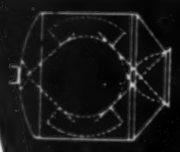
SUPERIOR non-clogging water bells, accessible for easy cleaning and maintenance.

ONE-MAN CHUTES



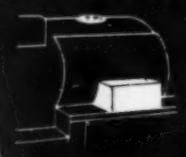
BEST for ease of handling and meeting practical operating conditions.

PROPER MIXING BLADES



DEEPER blades of unusual design for faster and more thorough mixing action.

SAFE GAS TANK



ACCESSIBLE for filling. Located on cat-walk, reducing fire hazard.

You get all of these advantages at no extra cost when you buy Blaw-Knox TRUKMIXERS and Agitators.

Investigate Blaw-Knox—the latest and most improved design of Truck Mixers and Agitators on the market today.

Blaw-Knox design gives you—Mixing efficiency . . . Ease of operation . . . Accurate water measurement . . . Speedy mixing . . . Freedom from breakdowns . . . Low maintenance costs . . . Long life . . . Safety and convenience.

Ask any user of Blaw-Knox Trukmixers or Agitators —get a reliable opinion.

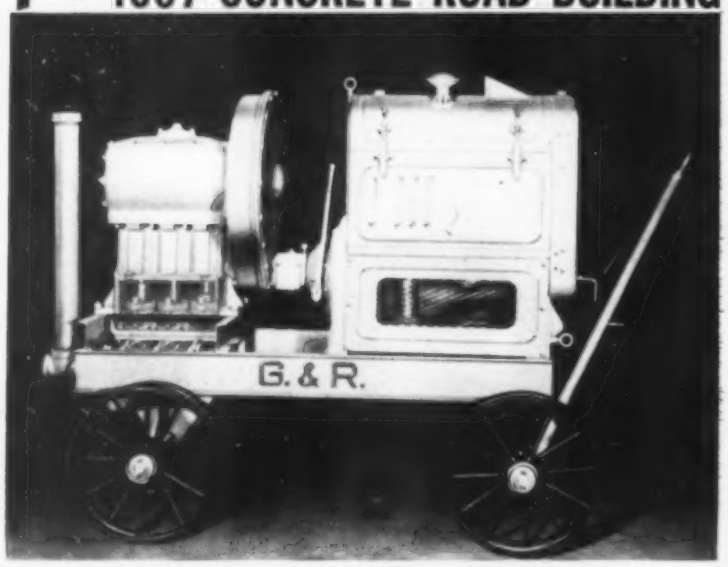
BLAW-KNOX COMPANY
2086 Farmer's Bank Building · Pittsburgh, Pa.
Offices and Representatives in Principal Cities

investigate

BLAW-KNOX

G & R Triplex Road PUMPS

Modern-Efficient DESIGNED FOR 1937 CONCRETE ROAD BUILDING



LARGE VOLUME AT HIGH PRESSURE

No need to skimp on water when you have a G & R Triplex on the job. Large volume at high pressure puts water where you need it at a big saving in piping costs. Here is the pump designed for 1937 road building.

NEVER AIR BOUND

Automatic Air Release now eliminates the bother of opening pet cocks by hand to release the air that every road pump picks up with the water. Your G & R Triplex is always delivering its full capacity to the job.

FULLY ENCLOSED — SELF OILING

All working parts of the pump are fully enclosed and deluged with oil. Simply fill the crankcase with oil. No hand oiling of any parts required.

PLUNGERS NOT DAMAGED BY SEDIMENT

Since the water end of the pump is below the pump body, any sediment in the water passes through the pump without having a chance to lodge in the plunger packing — a big advantage, assuring long plunger life.

BUILT FOR LONG, HARD SERVICE

Liberal use of Molybdenum alloy heat treat steel and oversize bearing, combine with the rugged design of G & R Triplex Pumps to assure long years of trouble free service. Be sure you know what you get in a Road Pump — compare them all with the G & R.

Get all the information on G & R Pumps before you buy any pump this year. They are the most dependable pumps at the lowest price.

THE GORMAN-RUPP CO., Mansfield, Ohio

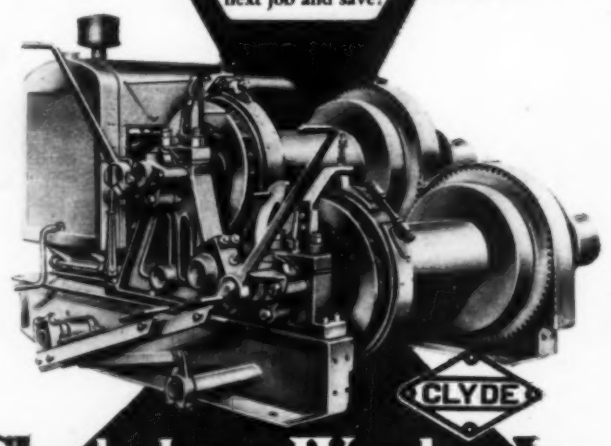
..leads the field

CLYDE GASOLINE HOISTS... quality machines in every sense of the word... are acknowledged the world over as leaders in value, performance and economical operation.

Built in a wide range of popular and practical sizes from 4 to 175 H.P., in one, 2 and 3 drum styles, these hoists embody all the latest features and developments that are necessary to give trouble free performance at the lowest operating cost. Put a clyde on your next job and save!

Below is shown a 55 H.P. double drum clyde Gasoline Hoist.

Write for Bulletin 40 which shows the complete line of Clyde Gasoline Hoists.



Clyde Iron Works, Inc.

DULUTH - MINN.

TRIMO

HAS FOR FIFTY YEARS MEANT ONE THING TO WRENCH USERS EVERYWHERE

STANDARD QUALITY

Trimo quality means a construction of Chrome Molybdenum Nickel Alloy Steel — hard gripping jaws — strength, safety, and economy wherever wrenches are used throughout industry.

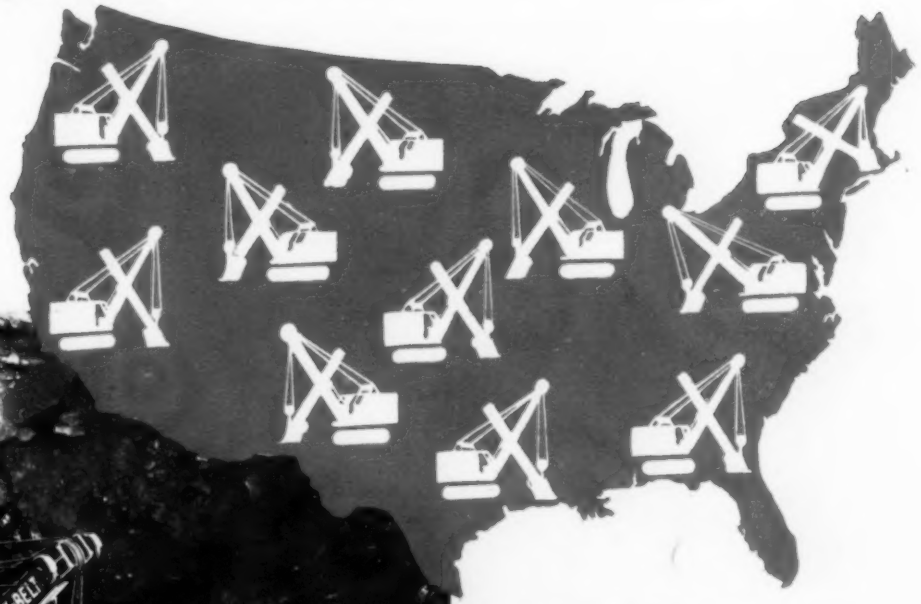
TRIMONT MFG. CO., Inc.
Roxbury (Boston), Mass.

The Red Tag, always attached to every Trimo, identifies Standard Quality.

PROVED

BY ACTUAL PERFORMANCE

from Coast to Coast



● Announcement of the development of Speed-o-Matic control, made less than a year ago, was hailed as revolutionary. So it is.

The scores of machines now in service from coast to coast and abroad are daily proving that these claims however startling, were not exaggerations.

The advantages of the Speed-o-Matic of most interest to contractors, can be summed up thus: Maintains Top Efficiency . . . Speeds Up the Job . . . Increases Output . . . Reduces Costs . . . Banishes Operator Fatigue.

Link-Belt Company, 300 W. Pershing Rd., Chicago. Offices and representatives in principal cities

7043

The relative ease of operation of the Speed-o-Matic (hydraulic control) shovel-dragline-crane, with its short, fast, easy-throw handles and foot pedals, and the conventional type of machine, with long, hard-throw, mechanical levers, can be compared to the drawing of water out of a faucet by simply turning a handle and the hand-pumping of water out of a pump. In the one case the operator merely controls the flow of the water; in the other instance, he actually has to pump it by his own effort.

LINK-BELT

Speed-o-Matic SHOVEL DRAGLINE CRANE

BAKER HYDRAULIC BULLDOZERS
BUILT FOR THE TOUGH JOBS

In selecting bulldozers, keep in mind the ability of a Baker to handle your toughest jobs with greater ease and with fewer delays. That is why so many leading contractors depend on Baker Bulldozers for their harder jobs.

Left, **Baker Model 215 Bulldozer on Model "L" A-C Tractor on a tough subway excavating job in Chicago. E. J. Albrecht & Co., Contr's, Chicago, Ill.**

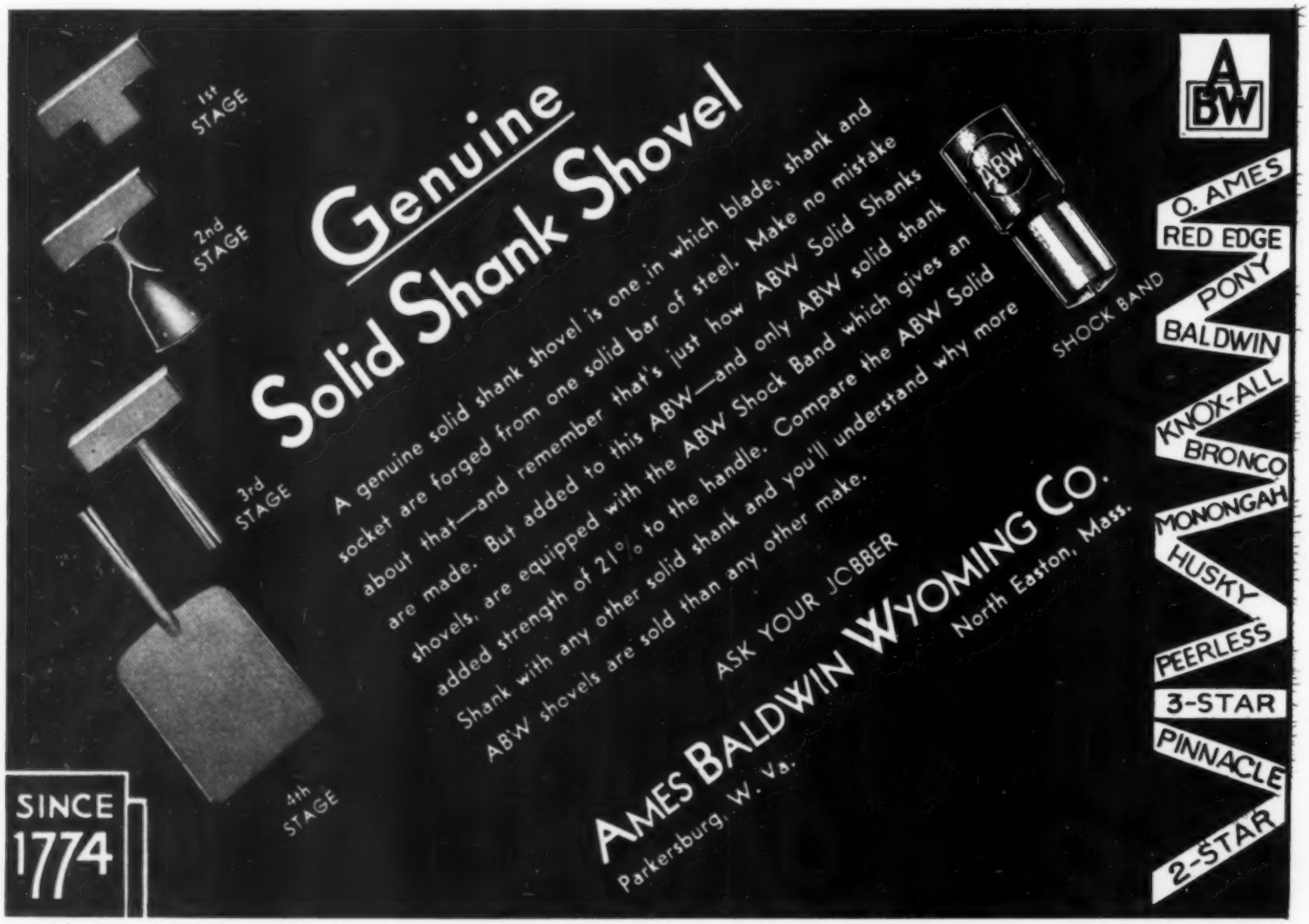
New!

BAKER HYDRAULIC SCRAPER

Model 180 Five Yard Scraper is new but it is already out-performing old-timers. Light, fast and easily controlled. Learn all about this outstanding scraper.

Send for Bulletin 591 (Scrapers) 587 (Bulldozers)

THE BAKER MFG. CO.
568 Stanford Ave. Springfield, Ill.


1st STAGE
2nd STAGE
3rd STAGE
4th STAGE
Genuine
Solid Shank Shovel
A genuine solid shank shovel is one in which blade, shank and socket are forged from one solid bar of steel. Make no mistake about that—and remember that's just how ABW Solid Shanks are made. But added to this ABW—and only ABW solid shank shovels, are equipped with the ABW Shock Band which gives an added strength of 21% to the handle. Compare the ABW Solid Shank with any other solid shank and you'll understand why more ABW shovels are sold than any other make.
ASK YOUR JOBBER
AMES BALDWIN WYOMING CO.
Parkersburg, W. Va.
North Easton, Mass.
SHOCK BAND
ABW
O. AMES
RED EDGE
PONY
BALDWIN
KNOX-ALL
BRONCO
MONONGAH
HUSKY
PEERLESS
3-STAR
PINNACLE
2-STAR
SINCE 1774

An Insurance Policy written in

Read how Shell men helped this company set a record!

A CONTRACTOR in a western city was about to start work on the Wolf Creek Highway. He needed an oil that would insure him against costly repairs and delays!*

The Shell men went to work with him. They took down the caterpillar tractors . . . pulled pistons . . . examined rings and valves. And they examined the oil, too. Then Shell men made their recommendation: A Shell Diesel Lubricant, especially developed by Shell scientists for this type of Diesel, was applied!

Let the contractor tell the rest! "Our tractors operated under heavy loads for 3,150 hours without any sign of trouble caused by sticking rings. This Shell Diesel Engine Lubricant has solved our problem . . . I'd recommend it to *any* user of Diesel engines!"

* * *

It took more than just good lubricants to score this record. All the ingenuity, resources and experience of a great refiner—Shell's "Invisible Element"—went into this job! This "Invisible Element" stands ready at all times to solve your lubricating problems. Call or write your nearest Shell office.

*An actual case history from Shell's files.

SHELL **SHELL** DIESEL ENGINE **LUBRICANTS**

YOU CAN'T BEAT IT... *for Strength, Flexibility and Easy Handling!*

GOODALL

"NEWTYPE"

U. S. Patent No. 1,948,410

SUCTION and DISCHARGE HOSE

GOODALL "NEWTYPE" is a smooth bore hose with a heavy elastic rubber tube that resists the cutting action of abrasives and insures a rapid, unchecked flow. A special wall construction permits *extreme flexibility*, and at the same time provides unusual strength and durability. Another important feature of "NEWTYPE" is that it can be quickly rounded into shape after being run over or otherwise crushed, without damage to tube or carcass. Add to these desirable characteristics the fact that "NEWTYPE" is unusually light in weight and easy to handle, and you realize why contractors everywhere depend on this hose for low cost, trouble-free service. *Put a length on the job, then check results!*

ONE HOSE for BOTH . . . SUCTION and DISCHARGE!

Stocked in all sizes up to and including 4", in maximum lengths of 50 feet. Other brands of GOODALL Suction Hose carried in sizes up to 12".

GOODALL RUBBER COMPANY

5 S. 36th St., PHILADELPHIA, PA.

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IS the Original and the Only Thoroly-Tested, Scientifically-Balanced and Specifically-Designed, Light-Weight, Heavy-Duty Power Shovel Made for Mounting on a Truck!

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5

The QUICK-WAY *there* — *The* QUICK-WAY *to do the job* — *The* QUICK-WAY *to the next one!*

BETTER PERFORMANCE LONGER SERVICE ON ANY JOB

"DIXON" AIR HAMMER COUPLINGS

Designed and built to withstand the continual vibration of hand hammers and rock drills, this Dixon coupling has a longer, consistently economical service life on the toughest job. And, like the "Boss," it is rust-proofed by Cadmium Plating.

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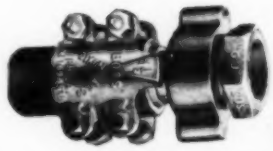

Used for steam hose, steam hammers, air, hydraulic or road builders' hose . . . "Boss" Couplings have no equal for dependability in service. Parts are of steel or malleable iron to withstand abuse . . . Cadmium Plated for rust proofing.

Furnished in Washer or Ground Joint Type.

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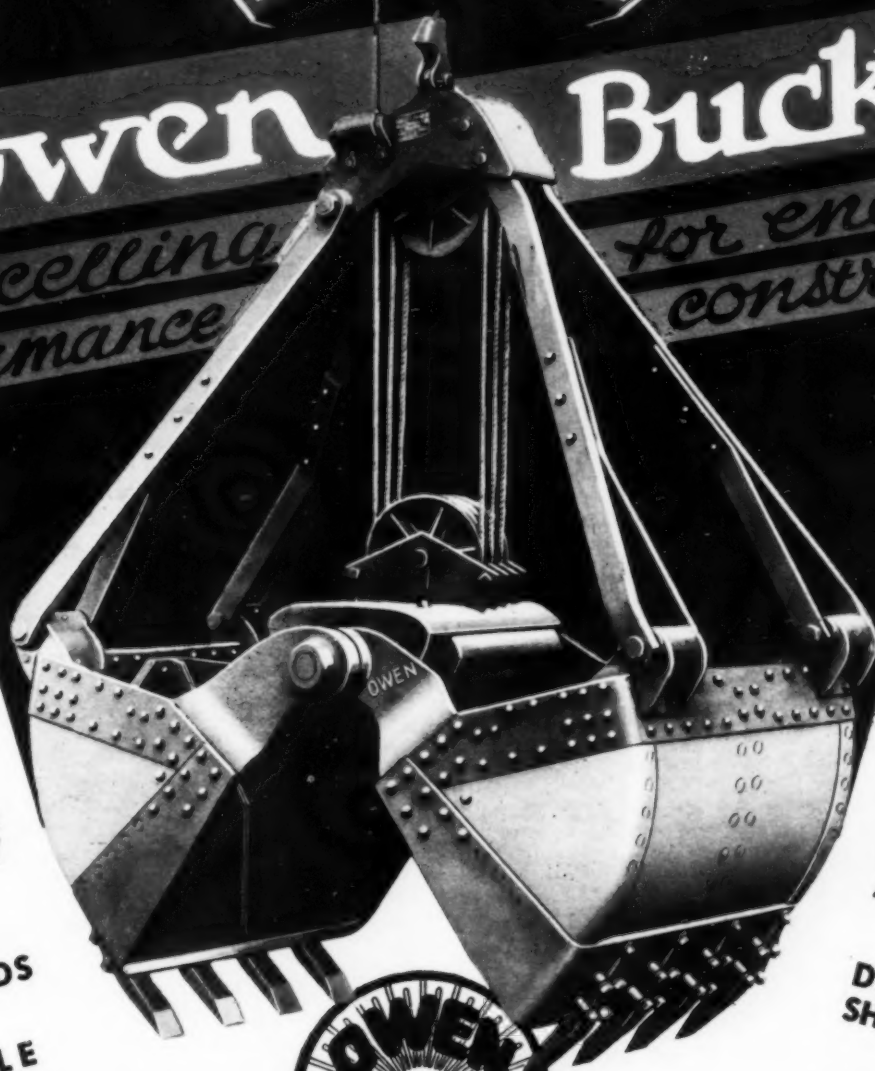
for enduring construction



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Opening in head allows bolt to pass clear through.

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The OSHKOSH is a utility tractor, not limited to any one type of job. It is equally efficient on short or long hauls. Trailer wagon can be quickly disconnected and tractor used for hauling scrapers or graders—or for moving materials or equipment, etc., thus eliminating necessity for duplication of tractor equipment.

- Speed up to 35 miles per hour
- Complete unit turns 31½ foot circle
- Capacity 10 to 15 yards
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The pay off in dirt moving is determined by scraper capacity and speed. That is why A-W 12-Yard Hydraulic Scrapers are independently powered to perform every loading, carrying and dumping operation. The whole power of the tractor is confined to the single job of steady pulling . . . assuring the largest possible load in the least possible time.

Remote control of the scraper from driver's seat eliminates all cables, sheaves, and winches; saves maintenance—makes it easy to unhook from the tractor in thirty seconds or less. Arched frame for right angle turns permits quick return from the dump.

These and other time-saving features add up to money making performance on every scraper job.

1. Housing containing hydraulic valves and magnetic control-mechanism whereby operator simply, easily and quickly controls all adjustments from tractor seat, by merely shifting three small levers.

2. Rear, push-out door moves forward hydraulically. Forcibly ejects load and spreads the material.

3. Pan floor has electric welded, reinforced *double-bottom* construction for maximum strength and service.

4. Rugged, front column equipped with heavy-duty cylinder for raising and lowering pan.

5. Aside from the draft pin, the only connection between scraper and tractor is the *single remote control cable* with its quick release plug.

Austin-W

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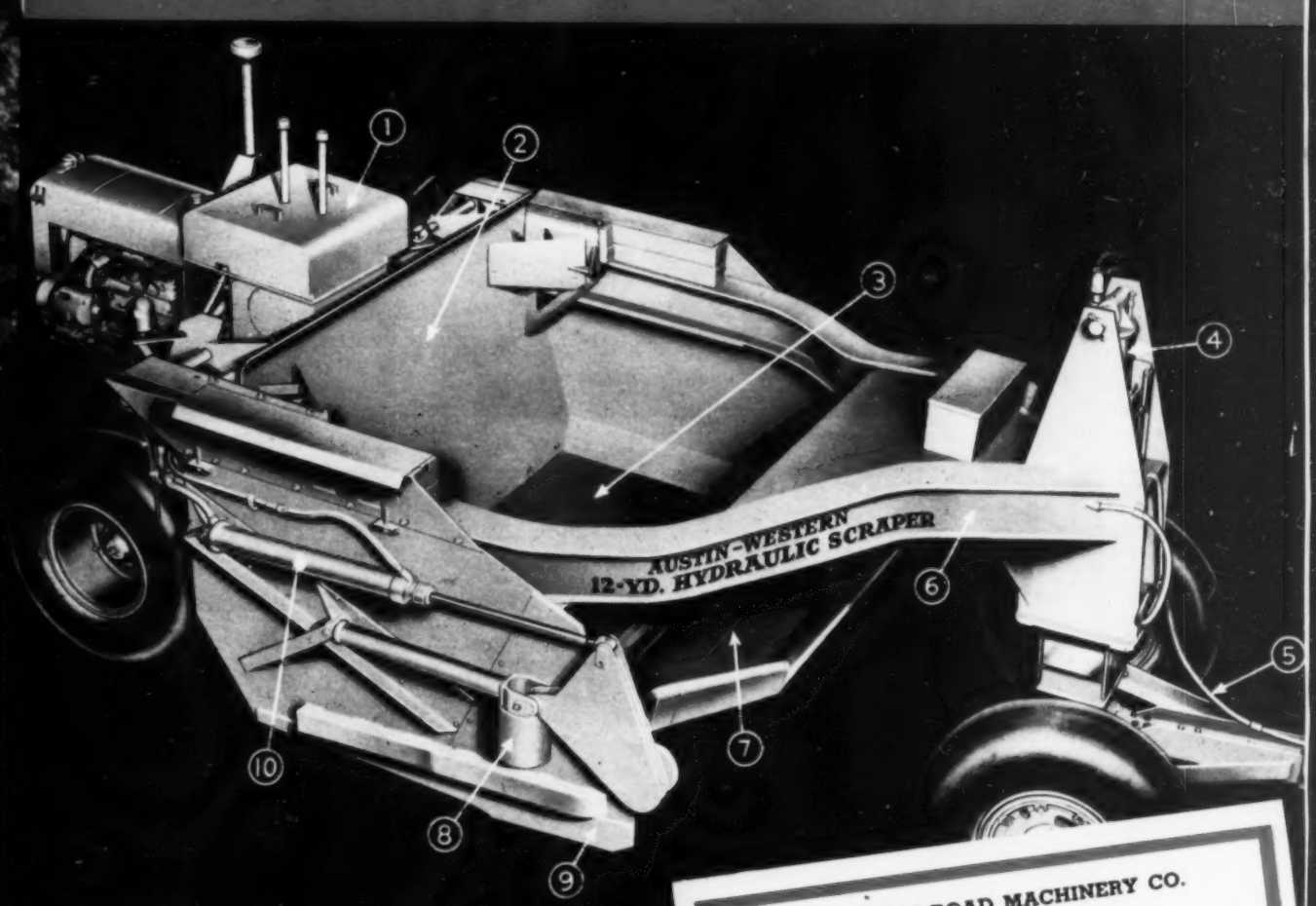
Means to Owners

- **IN YARDS PER HOUR**
- **IN COMPARATIVE PERFORMANCE**

Sam Galier, Engineer, Newhall Herker Construction Co., Cleveland, says: "We have used the Austin-Western 12-Yard Scraper for hauls from 300-1300 feet with output ranging up to 100 cu. yds. per hour" . . . Skrainka Construction Co., St. Louis, writes: "We have maintained an average of 90-100 cu. yds. per hour on a haul of approximately 700 ft. one way, even though our fills were very soggy" . . . Jacobson & McKinley, General Contractors, Pittsburgh, say: "As we compare the performance records of our A-W Scrapers with others, we are firmly convinced our A-W's are the best made."

Read below why these 12-Yard Scrapers give you the extra speed and capacity that make them outperform on scraper jobs; then mail the coupon.



6. Arched frame permits right-angle wheel turns when pan is down or in loading position.

7. Front gate in raised position provides ample unloading clearance; in closed position it is sufficiently high to retain maximum loads—there is no spillage when going downhill.

8. Floating mechanism which prevents damage to front gate should machine strike a boulder or other large obstruction.

9. Sides of pan extend forward, beyond cutting bit, to prevent escapage of material when loading.

10. One of two hydraulic cylinders which open and close front gate. Since gate is forced shut by power, the downward pressure exerted facilitates larger capacity loads.

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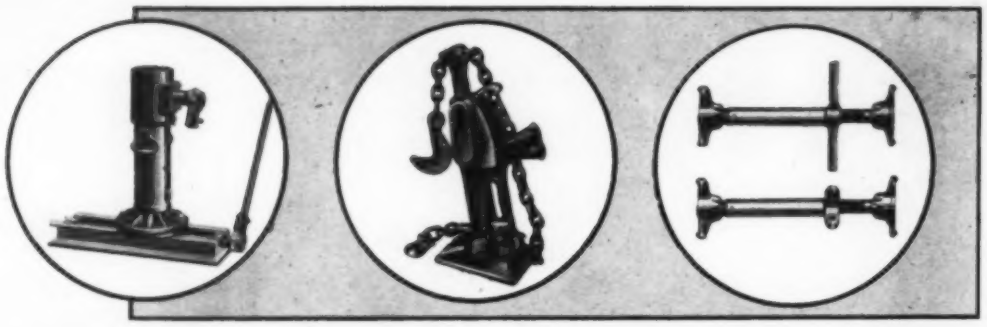

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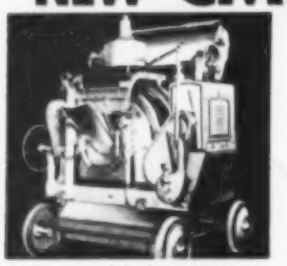

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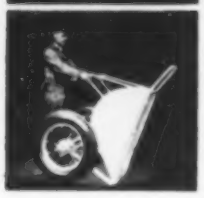

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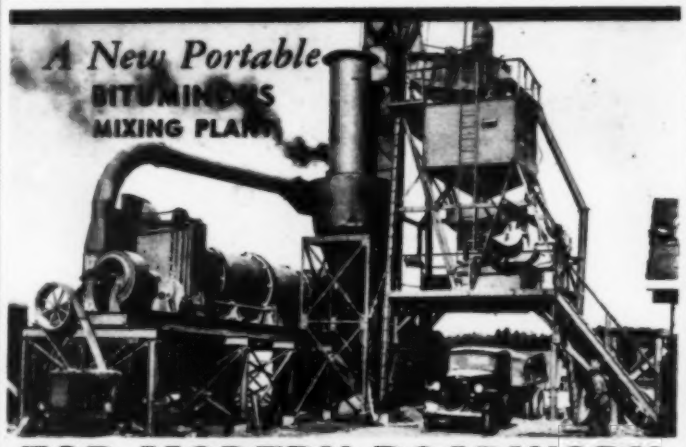

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Notice how the structure of wire changes during Macwhyte's cold drawing process. The upper photograph shows its structure before drawing—the lower photograph shows it after drawing. The lengthening and interlocking of steel fibres practically doubles the strength of Macwhyte wire and greatly increases its resistance to fatigue.

● Every coil of wire used in Macwhyte Wire Rope—both PREformed and non-preformed—must be checked in the Testing Department before it is released to the Rope Mill. A metallurgist here examines the structure of the wire through a powerful microscope.

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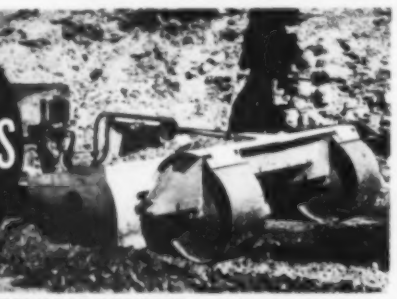

The Blaw-Knox (Ateco) BOTTOMLESS SCRAPER enables the contractor to operate his dirt moving job on a definite schedule and at a profit. It keeps dirt moving costs down.

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TAMPING ROLLERS

Tamp as you roll with a Blaw-Knox (Ateco) TAMPING ROLLER, a remarkably efficient and economical device for compacting heavy and light earth fills of every description. Meets requirements of all State and Government specifications.

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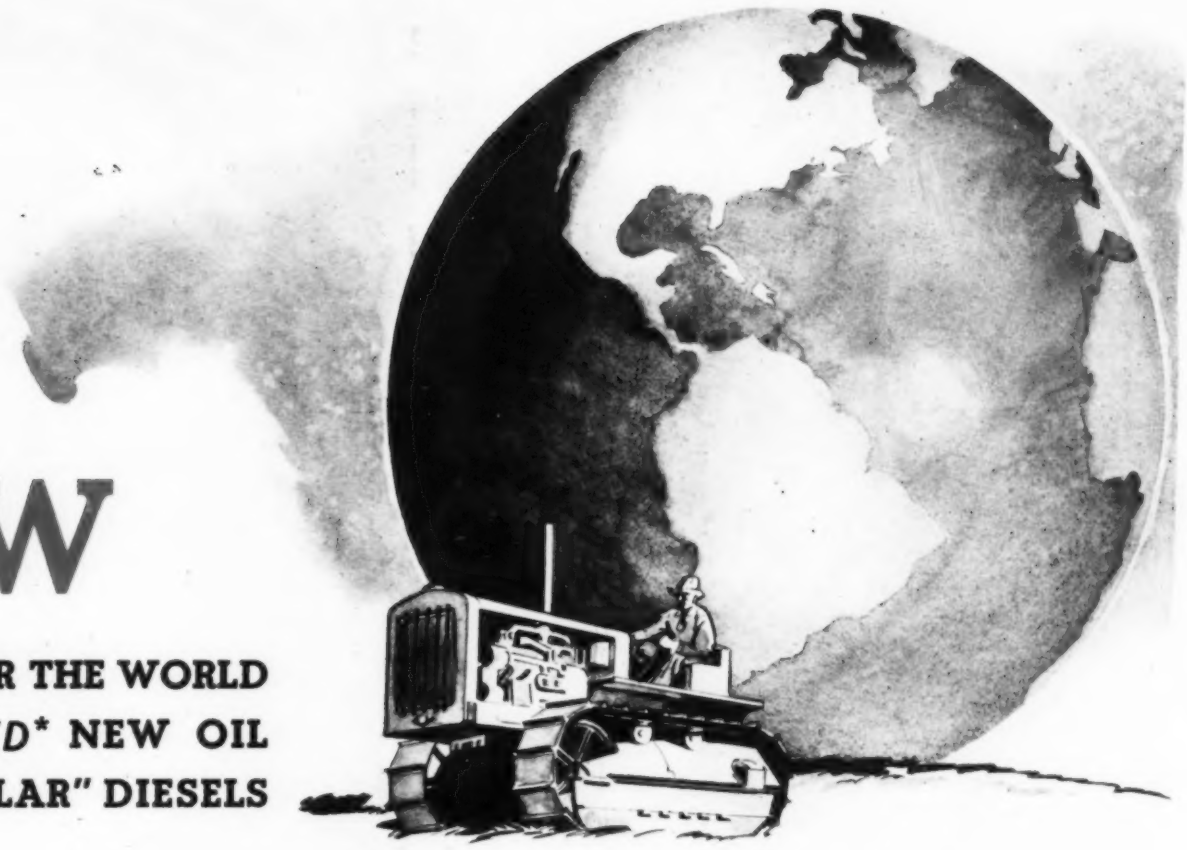

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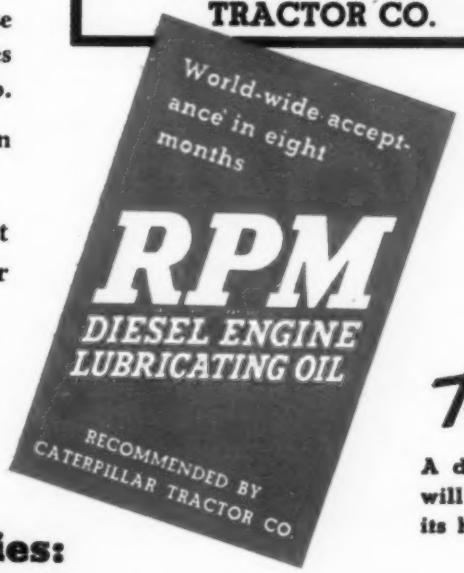

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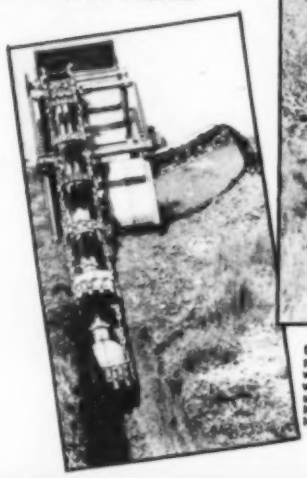
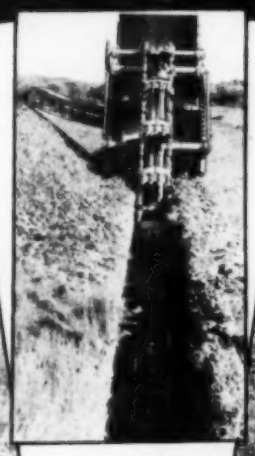
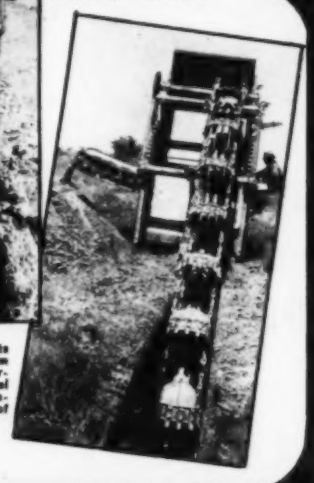
Dig to the left. Puts trench within 4 in. of curb or similar low obstructions.





Digs in any intermediate position. Set the boom where you want it. Dig forward or in reverse — tunnel under sidewalks, dig manholes, etc., saves days of hand labor.

Dig to the right. Puts trench within 10 in. of poles or similar high obstructions.



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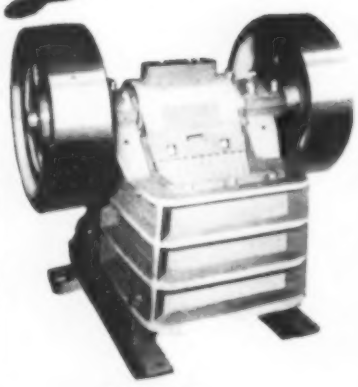

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*Estimated yardage — job now in process.
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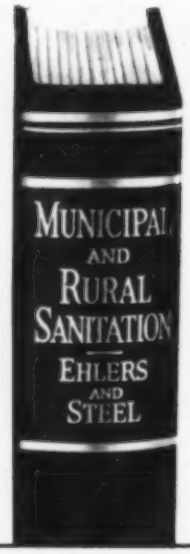

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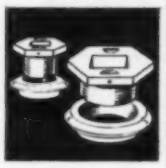

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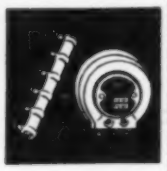

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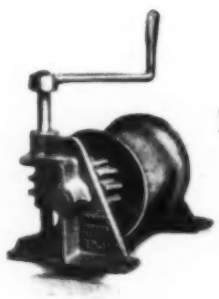

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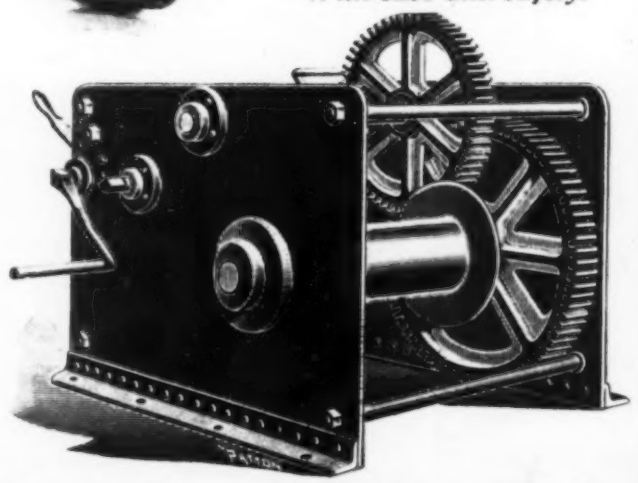

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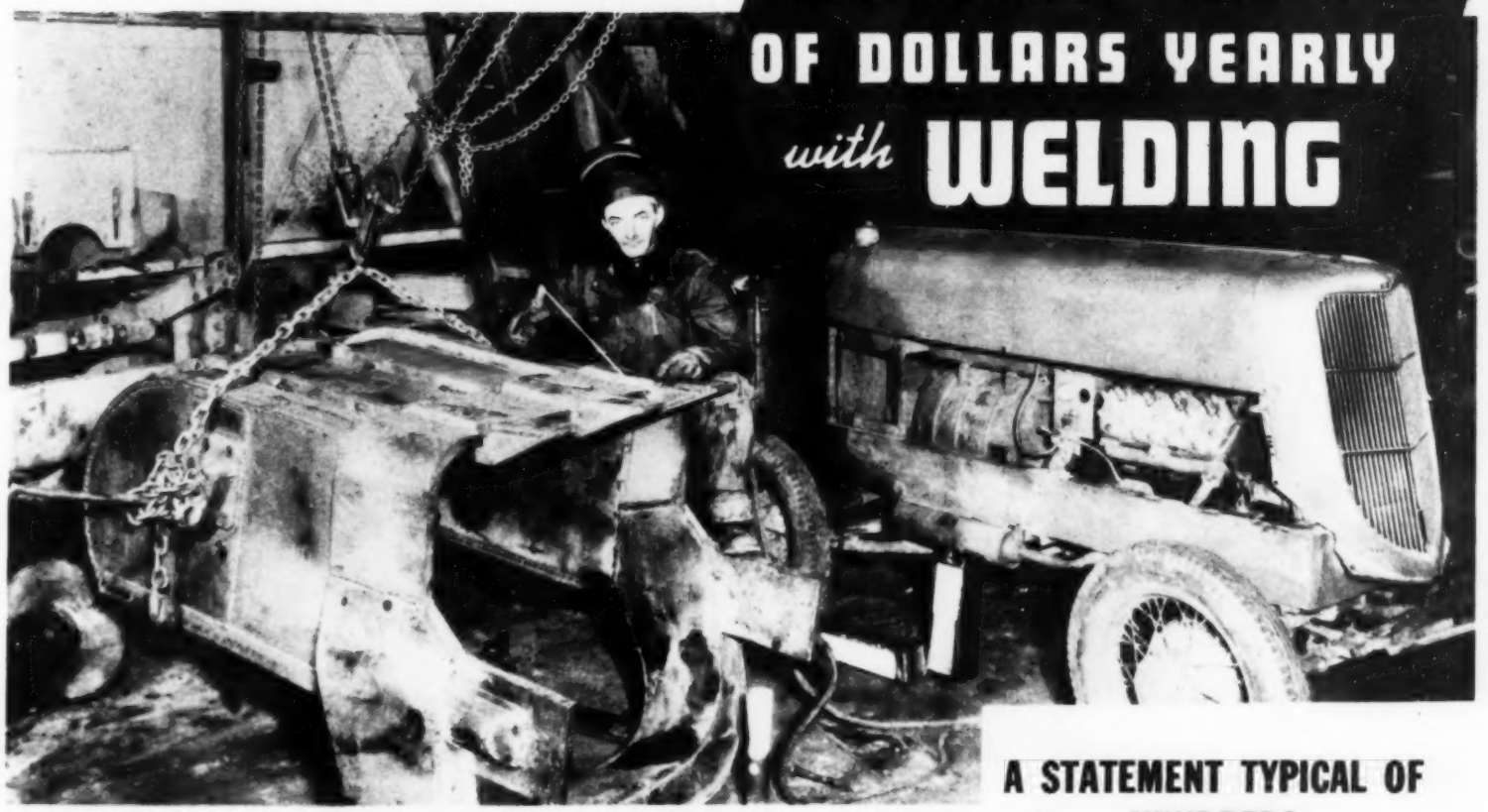

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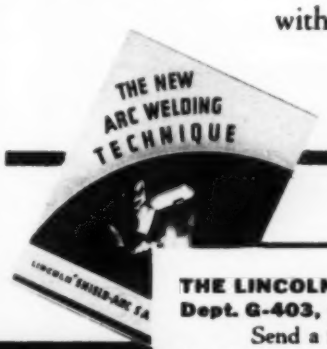

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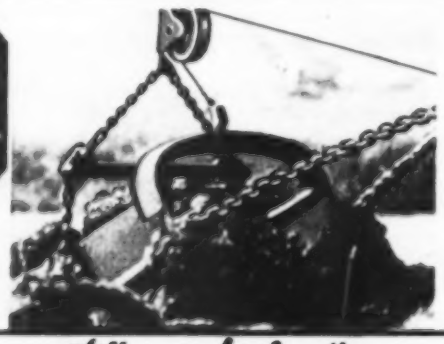

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TIRES REPLACE STEEL RAILS

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BY LOWELL THOMAS
NEWS COMMENTATOR

"Hauling out the logs in the northwest timberlands has always been a job for locomotives. Special track had to be built through the mountains. Logs came out on rails.

"They tried trucking. Tires broke down under the terrific loads. Others were cut and slashed to pieces by debris and undergrowth. Trucks mired in soft soil.

"Then Goodrich announced the Triple Protected Silvertown Tire. And truck logging, they tell me, became profitable. Now trucks haul tremendous log loads right out of the forest to the mill.

"Here's what Louis Joseph of Montesano, Washington, said in a recent interview: 'We have to take the roads as they come and frequently they are none too good. The loads are heavy and unbalanced. Yet with Goodrich Silvertowns I have never experienced a delay due to tire failure. Mileage is more than satisfactory.'

"There's a statement from a man who knows logging—and trucking—a hauling combination that means tire-killing service from the word 'go'."

Lowell Thomas has traveled all through the logging country. He could talk to you for hours about the makeshift roads, the steep climbs, the seemingly impossible tire jobs.

Do you know that you can get for your trucks the same tire that is making good on hundreds of logging operations? And you don't have to pay a premium price for it, either!

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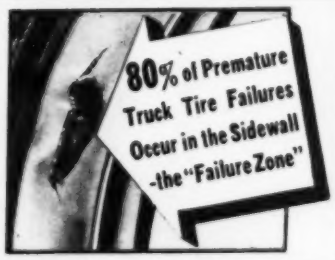

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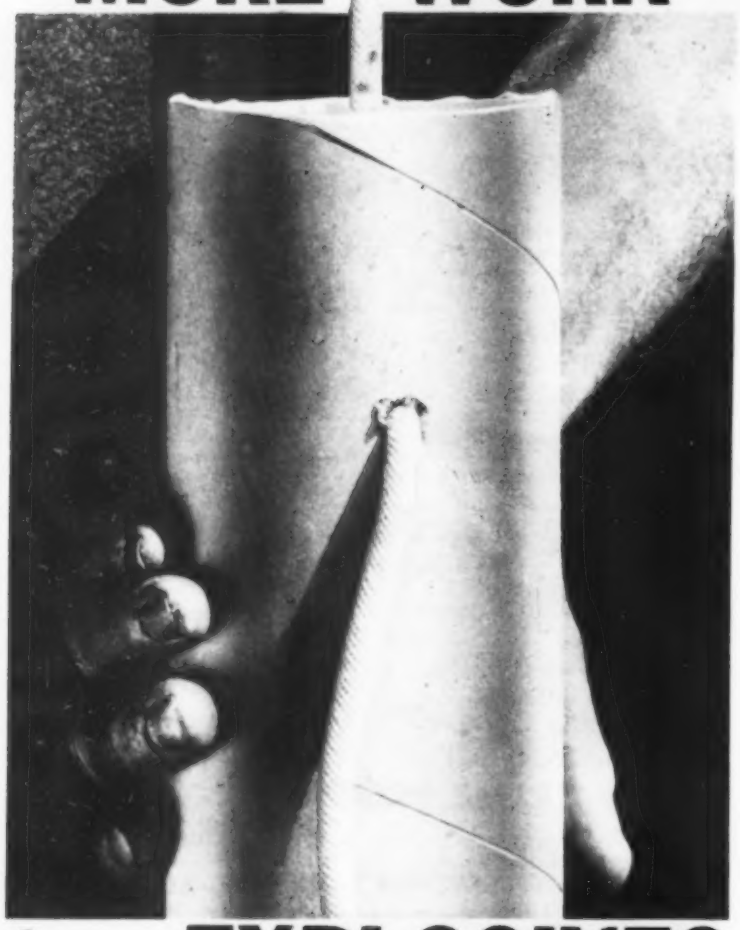

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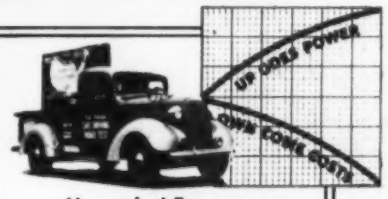

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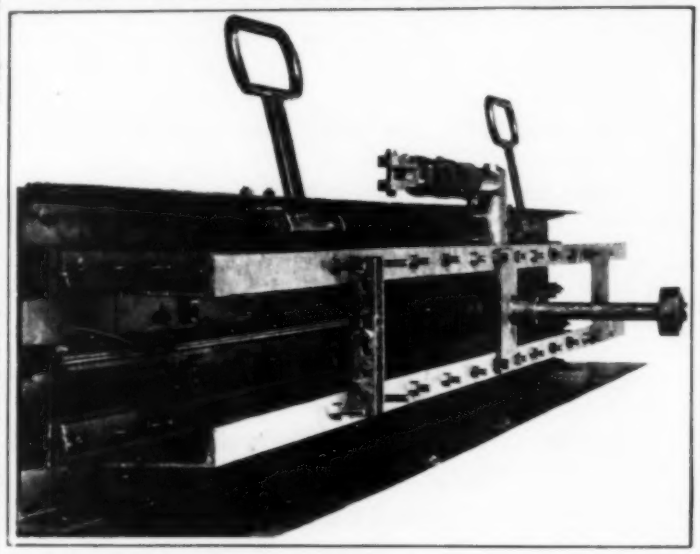

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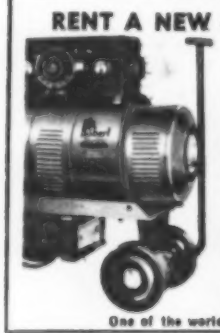

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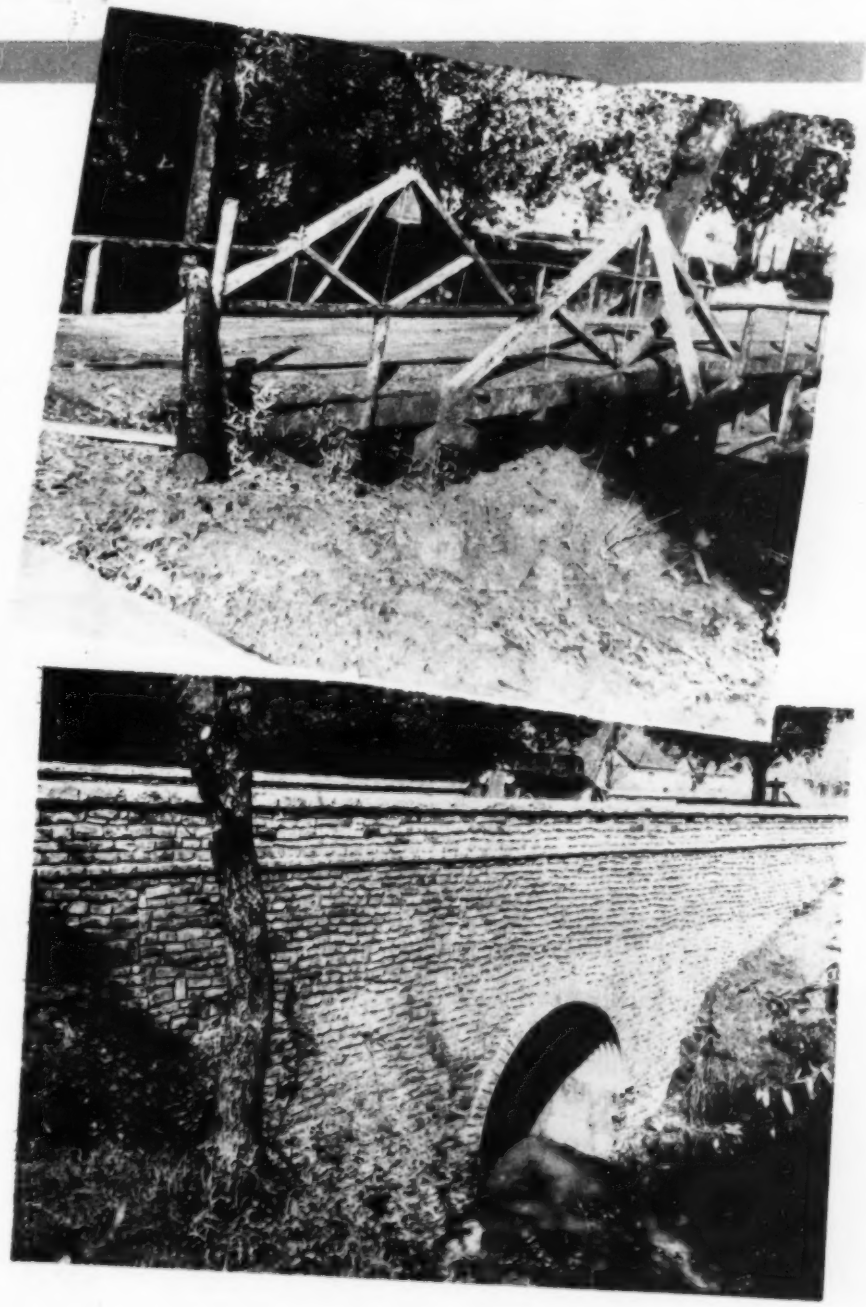

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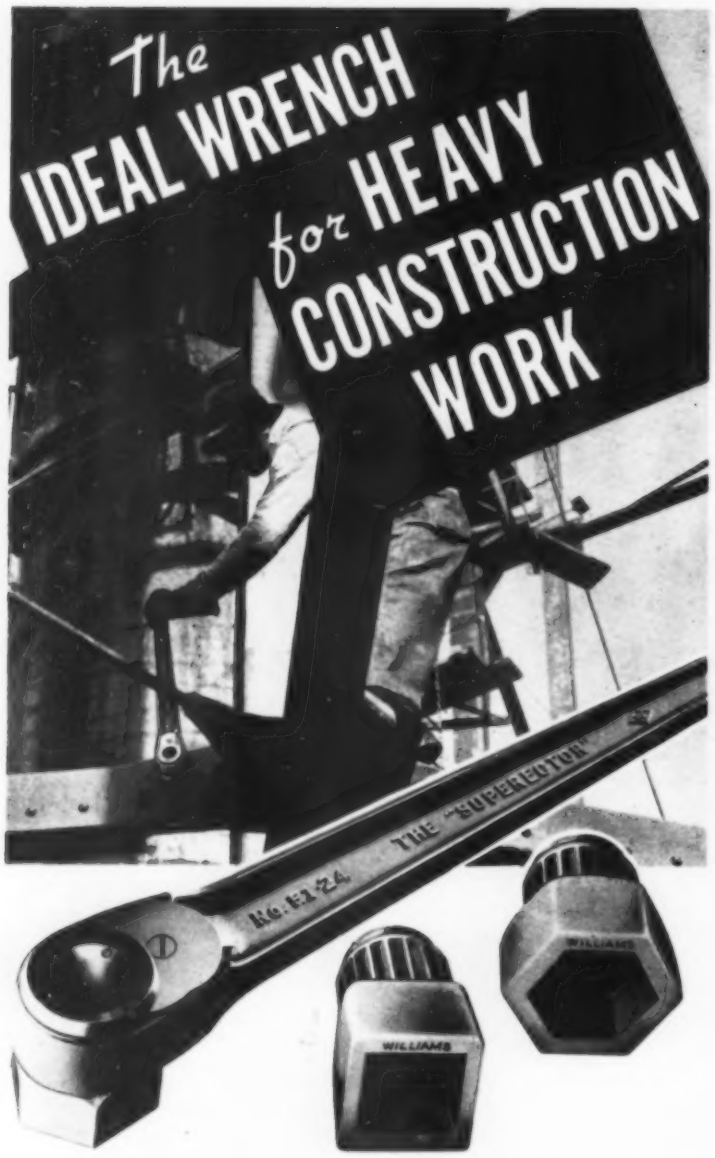

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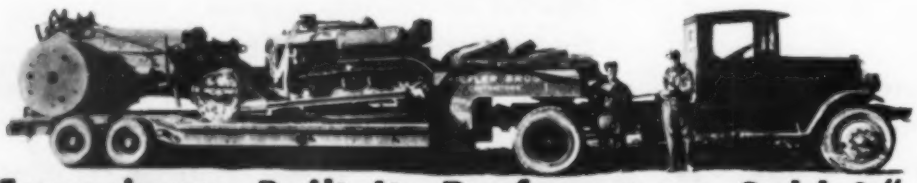

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"SEE HERE...TRU-LAY PREFORMED WIRE ROPE IS STANDARD EQUIPMENT WITH US"

● TRU-LAY Preformed wire rope is so superior that many manufacturers of industrial machines install it as standard equipment—then use that fact as a sales argument.

And small wonder. Literally thousands of wire rope users have long since learned the greater dollar value that comes through Tru-Lay Preformed. It is both easy and safe to handle; it resists the fatigue of bending over sheaves; it resists rotating in sheave or drum grooves; it gives unusually long service.

Indeed, Tru-Lay Preformed has so lengthened the "period of expectancy" in wire rope service that both buyers and sellers of industrial machines know the value of the name "Tru-Lay" when applied as "standard equipment."

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✲ ALL AMERICAN CABLE DIVISION ROPES MADE OF IMPROVED PLOW STEEL ARE IDENTIFIED BY THE EMERALD STRAND

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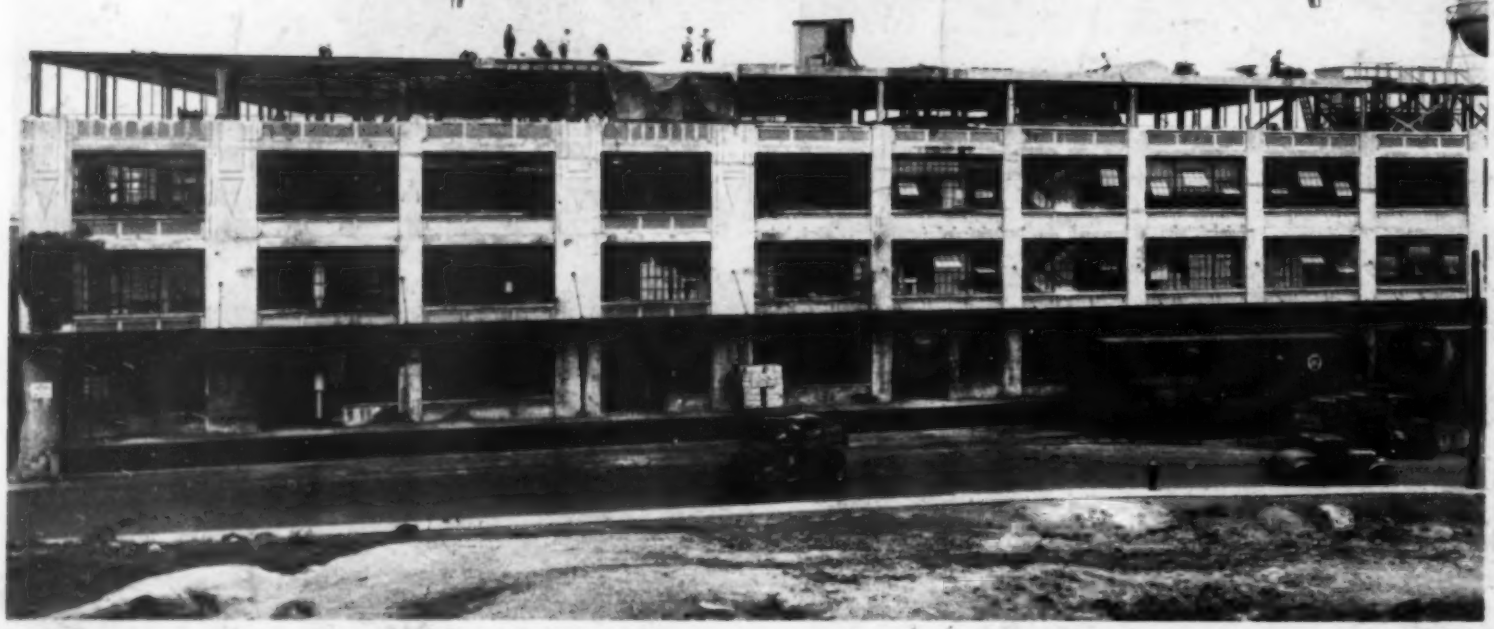

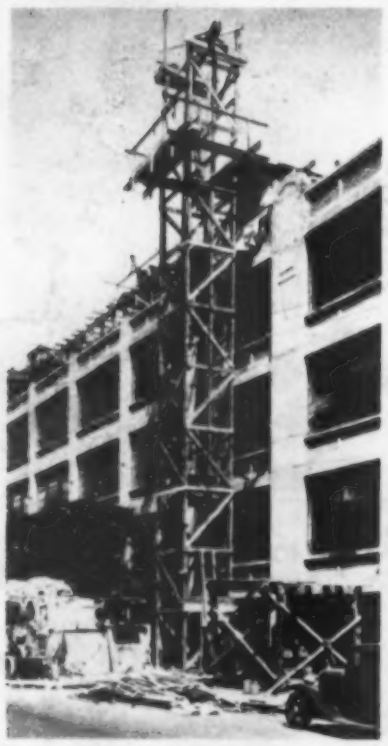

Plant of the American Home Products Corp., Jersey City, N. J. W. H. Brush, Engineer. Hudson Concrete Construction Co., Jersey City, General Contractor. George Peterson, Inc., Harrison, N. J., Concrete Contractor. Inset shows the dense, perfect surface of the Lehigh Early Strength Cement Concrete.

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